# DISSERTATION ON

# STUDY ON SPECTRUM OF HEART DISEASES IN CHILDREN AGED 1 MONTH TO 12 YEARS

**Dissertation submitted to**

**THE TAMILNADU DR. M. G. R. MEDICAL UNIVERSITY**

**In partial fulfillment of the regulations**

**for the award of the degree of**

**M.D. DEGREE IN PEDIATRIC MEDICINE**

**BRANCH – VII**

**GOVERNMENT THENI MEDICAL COLLEGE**

**THENI – 635531**

**THE TAMILNADU DR. M. G. R. MEDICAL UNIVERSITY**

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## CERTIFICATE

This is to certify that the Dissertation entitled **"STUDY ON SPECTRUM OF HEART DISEASES IN CHILDREN AGED 1 MONTH TO 12 YEARS"** is a bonafide record of work done by **Dr. N. SREEMAN,** in the Department of Pediatrics, Government Theni Medical College ,Theni, during his Post Graduate Course from 2015 to 2017. This is submitted as partial fulfillment for the requirement of **M.D.,** Degree examinations – Branch- VII(Pediatrics) to be held in April 2017.

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Dissertation Topic : STUDY ON SPECTRUM OF HEART DISEASES IN CHILDREN AGED 1 MONTH TO 12 YEARS.

The Ethical Committee, Government Theni Medical College has decided to inform tha your Dissertation Topic is accecpted and you are permitted to proceed with the above study.

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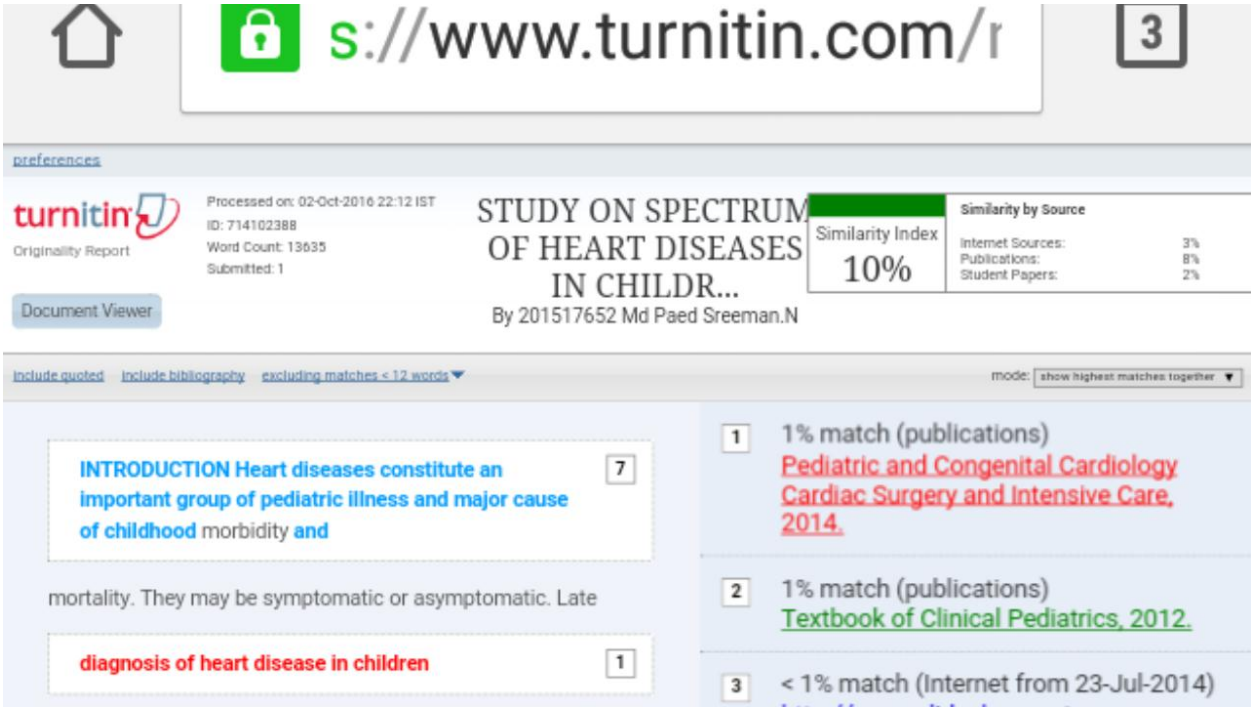
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INTRODUCTION Heart diseases constitute an important group of pediatric illness and major cause of childhood morbidity and
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## DECLARATION

**I, Dr. N. SREEMAN,** solemnly declare that the Dissertation titled**"STUDY ONSPECTRUM OF HEART DISEASES IN CHILDREN AGED 1 MONTH TO 12 YEARS"**is abonafide work done by me in the Department of Pediatrics, Government Theni Medical College Hospital, Theni, during the period July 2015 – June 2016.

The Dissertation is submitted to **"The Tamilnadu Dr. M.G.R. Medicaluniversity, Chennai"**, Tamilnadu as a part of fulfillment for the requirement of **M.D**.Degree examinations-Branch-VII(Pediatrics) to be held inApril 2017.

Place: Theni **(Dr. N. SREEMAN)**

Date:

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## ABBREVIATIONS

| | |
|---|---|
| **ACHD** | **Acyanotic congenital heart disease** |
| **ASD-OS** | **Atrial sepyal defect ostiumsecondum** |
| **AS** | **Aortic stenosis** |
| **BAV** | **Bicuspid aortic valve** |
| **BVH** | **Biventricular hypertrophy.** |
| **CHD** | **Cyanotic congenital heart disease** |
| **CI** | **Confidence interval** |
| **DORV** | **Double outlet right ventricle.** |
| **DCM** | **Dilated cardiomyopathy** |
| **ECG / ECHO** | **Electrocardiogram / Echocardiogram** |
| **FTT/ FTGW** | **Failure to thrive/ Failure to gain weight** |
| **LAE / LVH** | **Left atrial enlargement / Left ventricular hypertrophy** |
| **MVP** | **Mitral valve prolapse** |
| **MR / MS** | **Mitral regurgitation / Mitral stenosis** |
| **PDA** | **Patent ductusaeteriosus** |
| **PS** | **Pulmonary stenosis** |
| **RAE / RVH** | **Right atrial enlargement / Right ventricular hypertrophy** |
| **RAD / RBBB** | **Right axis deviation / Right bundle branch block** |
| **RF/RHD** | **Rheumatic fever / Rheumatic heart disease** |
| **VSD** | **Ventricular septal defect** |
| **TA** | **Truncusarteriosus** |
| **TOF** | **Tetrology of Fallot** |

# CONTENTS

# INTRODUCTION

# INTRODUCTION

Heart diseases constitute an important group of pediatric illness and major cause of childhood morbidity and mortality. They may be symptomatic or asymptomatic. Late diagnosis of heart disease in children carries a high risk of mortality and morbidity. To avoid this mortality and morbidity early diagnosis is important.

Heart diseases in children may be congenital or acquired. Congenital heart disease is the one present since birth. Some cases of congenital heart diseases are asymptomatic and are diagnosed on routine health visits[1].

Acquired heart diseases in children are less frequent than adult. Acquired Cardiac diseases represents a diverse group of heart diseases which occurs after birth. Acquired heart diseases, though known to have global distribution, their relative burden and pattern of its distribution vary between regions across the world even withinthe particular geographical area[2]

It is important to mind that children with congenital heart diseases are at increased risk of poor growth. The factors which play a role in the poor growth may be feeding Difficulties, excessive caloric requirement and the cardiac lesions on growth and development.[3]with chronic acquired heart diseases also at increased risk of poor growth.

## CLASSIFICATION OF HEART DISEASES IN CHILDREN

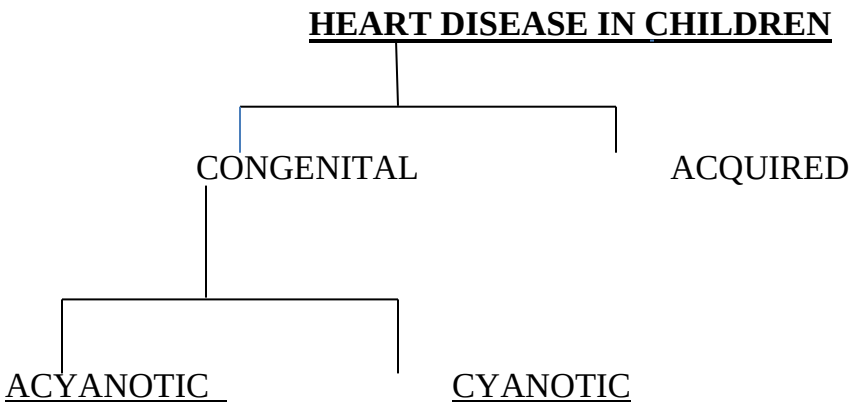
Heart diseases in children may be classified into Congenital and Acquired . Congenital lesions are further divided into two major categories. Acyanotic and Cyanotic.

Acyanotic lesions further divided into three main categories[4]

1. Left to right Shunt,
2. Acyanotic obstructive lesions,
3. Acyanotic regurgitant lesions.

Cyanotic lesions are further divided into two major categories.

1. Lesions with decreased pulmonary blood flow.
2. Lesions with increased pulmonary blood flow.



ACQUIRED LESIONS

1.Rheumatic fever

2.Myocarditis/ Cardiomyopathy

3.Kawasaki disease

4.Pericardial effusion

5.Tumours of heart

## Prevalence and epidemiology of heart diseases in the globe and India

The incidence of congenital heart disease is about 0.8 percent. Roughly about 8 to 12 per 1000 live birth. This does not include PDA of preterm infants[5] There are certain differences in the incidence of various types of CHDs in differentPopulation.The best example of these is high proportion of sub arterial VSD in China and Japan ( about 35% vs 5% in Caucasians). There is also increased incidence of TOF and other form of Right ventricular outflow tract obstruction in Malta. Fixler et al observed that AS and Coarctation is more common in Caucasians than in the black population or Hispanic population[6]

The prevalence of complex and cyanotic defects are more common in males. All the left heart defects and particularly hypoplastic left heart, aortic stenosis and coarctation are more common in males. Less severe defects like ASD, PDA and atrio ventricular septal defects are common in females. Ventricular septal defects and pulmonary stenosis are evenly distributed in both sexes.

In INDIA the incidence and prevalence of CHD is quite likely to be on the higher side due to high birth rate in India. Some hospital based and some communitybased studies reveals that Incidence of various lesions has varied. The incidence of moderate and severe forms of heart diseases is about 6 per 1000 live births.

But when all the lesions are included like the trivial lesions ie tiny muscular VSDs , the incidence increases to 75 per 1000 population. In an Indian study it is reported that the incidence of congenital heart disease is more in girls than in boys.

While considering acquired heart diseases in children Rheumatic fever is the most common disease and followed by Kawasaki disease. Although rheumatic fever is rare in developed countries. They are still causing a predominant public health problem in developing countries. In 1994 it is estimated that 12 million were suffered from rheumatic fever and rheumatic heart diseases and about 3 million were suffered from congestive cardiac failure.

The prevalence of rheumatic fever and rheumatic heart diseases also have been estimated in surveys mainly in school aged children which shows there is a wide variation in between the countries ranging from 0.2 per 1000 to 77.8 per 1000. Theprevalence of rheumatic fever and rheumatic heart diseases and the mortality rates are also varied from country to country, even in the population groups within the same country. Some data shows that rheumatic heart diseases accounts for 12 – 65 percentage of hospital admissions related to cardio vascular diseases[7]

And there has been a much decrease in the mortality, incidence, prevalence, hospital morbidity and severity of rheumatic fever and rheumatic heart diseases in some places worldwide. Implementation of health programs and prevention programs might be the reason for the same. .Even after near elimination of rheumatic fever in USA, there had been a much resurgence there , which probably indicate there may be a cyclical fall and rise in the developed country too.

In India, the prevalence of rheumatic fever and rheumatic heart diseases ranges from 0.9 to 6.4 per 1000 population. In India also the varied prevalence is reported from region to region. In Kochi, it was estimated to be as very low as 0.05 per1000 population. In SAT hospital Trivandrum , Rheumatic fever is still continues to be the most common acquired cardiac illness followed by Kawasaki disease. In rural Uttar

Pradesh the prevalence is about 6.4 per 1000 population. In Rajasthan it is about 3.4 per 1000 population This all indicates the regional variation in the prevalence of rheumatic fever and rheumatic heart diseases.

A conservative estimate puts the figure of the total rheumatic fever and rheumatic heart disease burden in India as 1 to 2 million and the incidence approximately about 50,000 per year[8]

A survey conducted by Indian Council of Medical Research, on children aged 6 to 16 years showed that the incidence of rheumatic fever is about 5.3 per 1000 population[9] . As we discussed above, Some selected parts of India has experienced improved human development and reporting a significant decline in the incidence of rheumatic fever.

The reasons for the declining in the incidence of rheumatic fever may be due to

1.Improved environmental and social conditions.

2.Increased use of antibiotic in upper respiratory tract infections

3.Better housing and easier access to medical care.

4.Possibly decreased virulence of bacteria.

5.Impact on secondary prophylaxis.

# Clinical evaluation of the child with heart diseases

The clinical history, physical examination, chest radiography and electrocardiogram are the keystones in the diagnosis of heart diseases in children.

Symptoms of congenital heart diseases are variable, sometimes asymptomatic, subtle and may manifest anytime from fetal period to adulthood. Usually critical congenital heart diseases present early in life. Some may go undiagnosed and identified in later life incidentally because of asymptomatic murmur. Rheumatic fever and rheumatic heart diseases usually occurs in between 5 - 15 years of age. Viral myocarditiscan occur at any age. Kawasaki disease usually in 3-5 years old child.

## History

History of any fever with rashes as in Rubella should be enquired in the mother. Congenital Rubella syndrome may presents with PDA or peripheral pulmonary artery stenosis.

TABLE-1 **Maternal Illness causing Cardiac Malformations**

| **Maternal illness** | **Cardiac malformation in baby** |
|---|---|
| Maternal diabetes | Septal hypertrophy/TGA/VSD/PDA |
| SLE/ mixed connective tissue disorder | Congenital complete heart block |
| Maternal rubella | Pulmonary artery stenosis/PDA |
| Maternal CHD | Any form of CHD(1 to 15 %) |

History of drug intake may give some clues towards the diagnosis.

**Table-2 Maternal drug intake causing cardiac disease**

| Teratogens | Associated manifestations |
|---|---|
| Phenytoin | Septal defects and or transpositions |
| Carbamazepine | ASD/PDA |
| Trimethadione | Transposition/ TOF |
| Sodium valproate | TOF/ transposition |
| Lithium | EBSTEIN"S anomaly |
| Warfarin | Various septal defects |
| Anti malignancy drugs | TOF/ dextrocardia |

Some cases of congenital heart diseases are asymptomatic and presents with only heart murmur. The heart diseases are diagnosed on routine health check up[10]

The main symptoms of heart diseases may be specific or non specific. The non specific symptoms are poor feeding, failure to thrive or poor weight gain , poor exercise tolerance. Developmental delay may be a presenting symptom. Easy fatigability and diaphoresis may be the other presenting symptoms. Easy fatigability presents as

difficulty in feeding in newborns and in infants.

The specific symptoms are chest pain, palpitation, syncope, cyanosis, dizziness, breathlessness and recurrent respiratory tract infection[11]

## Table-3 Symptoms in congenital cardiac diseases

| Symptom or sign | Significance |
|---|---|
| Chest pain | May be related to AS |
| Cyanosis | Structural cardiac lesion with restricted Poor pulmonary flow |
| Dizziness | CCF or Hypoxia |
| Syncope | AS / HOCM |
| Palpitation | Arrythmias secondary cardiac structural lesion. |

## Table-4 Respiratory Symptoms of Cardiac Disease

| Symptom | Significance |
|---|---|
| Dyspnoea while exertion | CCF, Hypoxia, Poor cardiac output |
| Chronic cough | Pulmonary vascular congestion |
| Asthma like symptoms | Pulmonary congestion |

Table-5 **Constitutional symptoms in heart disease**

| **Symptom** | **Significance** |
|---|---|
| Poor growth or Failure to thrive | CCF, Left to Right shunt with pulmonary hypertension or a genetic syndrome |
| Diaphoresis | CCF |
| Easy fatigability | CCF |
| Developmental delay | CHD/ CHD with genetic syndrome. |
| Poor exercise tolerance or capacity to play | Hypoxia/ CCF |

**Table-6 Symptoms in acquired heart diseases**

| **Symptom** | **Significance** |
|---|---|
| Fever | Rheumatic fever, Infective endocarditis , viral myocarditis, Kawasaki disease |
| Fever with migratory arthritis | Rheumatic fever |
| Palpitation | Viral myocarditis |
| Breathlessness , cough | CCF in acquired heart diseases |
| Leg swelling | CCF in acquired heart diseases. |
| Chest pain | Pericarditis( Rheumatic) |

**Developmental history**

Always get a detailed developmental history from the parents. CHD affects the neurodevelopment across the lifespan. In infants developmental delay can occur,

ranging from mild hypotonia to persistent delay affecting many aspects of development including language, social skills and feeding. Some children reach early milestones normally, but school demands an unmask impairment that are not apparent at younger ages. Aspects of neurodevelopment most commonly involved in school aged children are organization, visuo spatial skills mathematics, memory and language. Some children struggle with social skills , depression and anxiety. Attention deficit hyper active disorder also occurs, often accompanied by other learning problems.

The spectrum of neurodevelopmental impairment is wide. Some children have minimal or no impairment, whereas others are severely affected. In general , children with milder form of diseases like ASD and VSD, have fewer neuro-developmental sequelae than those with complex lesions like single ventricle or Hypoplastic heart syndromes. But medical, environmental and genetic factors all play a Role[12]

## Physical examination in children with heart diseases

**General examination:**

Look for overall appearance of the child. Note whether the child is comfortable are dyspnoeic or tachypnoeic. Look for obvious dysmorphic features. Some syndromes shows dysmorphic facies may associated with congenital heart diseases. Look for anycongenital markers like microcephaly, cataract.

Measure head circumference: congenital rubella syndrome may associated with microcehaly.

Height: Short stature in Down syndrome

Cataract: In congenital rubella syndrome, Down syndrome

US/LS ratio, Arm span: Marfan syndrome

Syndactyly, Polydactyly : Down syndrome, Turner syndrome

High arched palate: Marfan syndrome

Table-7 **Some syndromes associated with congenital heart diseases**

| **Syndromes** | **significance** |
|---|---|
| Down syndrome | Atrio ventricular septal defects |
| | VSD/ASD/TOF/PDA |
| Holt Oram syndrome | ASD/ VSD |
| Noonan syndrome | PS / ASD /VSD / TOF/ HOCM |
| Turner syndrome | CoArctation of Aorta, PDA |
| | Conotruncal anomalies, AV canal defects, |
| Trisomy 13 | Polyvalvular dysplasia. |
| Trisomy 18 | Conotruncal anomalies, Complete AV |
| | Canal Defect, poly valvular dysplasia |
| DiGeorge syndrome | Conotruncal defects. |
| Ellis van crevald syndrome | Common atrium, AV canal defect, |
| | heterotaxia |
| Alagille syndrome | Peripheral pulmonary stenosis. |
| Goldenhar syndrome | AV canal defect, Conotruncal defect, TOF |
| Cri du chat syndrome | VSD /PDA / TOF |
| Pierre Robin syndrome | ASD /VSD /PDA |
| CHARGE association | Atrio ventricular septal defect, TOF |
| VACTERL association | VSD /ASD |

**Look for signs of infective endocarditis**: Petechiae, splinter hemorrhage,

Oslers node, Janeway lesion

## Vitals examination

**Pulse:**

Rate

Sinus Tachycardia:

| | |
|---|---|
| Fever | CCF |
| Anxiety | Cardiac Tamponade |
| Pain | Sepsis |
| Large left to right shunt | Hyperthyroidism |
| Anemia | Pulmonary diseases |

Sinus Bradycardia:

Athletes, Hypothyroidism,

Heart Block

Supraventricular Tachycardia: Rate more than 220 beats per minute

Rhythm

Regular

Irregular – Regularly irregular – Atrial fibrillation

-Irregularly irregular - Atrial fibrillation

Volume: Best assessed in carotids.

Normal: Normal children

ASD. TOF

Large volume( Bounding pulse):

PDA

Anemia

Persistent Truncus Arteriosus

AV fistula

High fever

Small volume pulse (Weak thread pulse):

CCF

Shock

Leg pulses in coarctation of aorta

Radio Femoral delay

Coarctation of aorta

Radio Radial Delay

Preductal coarctation of aorta

Subclavian artery stenosis

Special character

Look for special characters like Water hammer pulse, pulses parvus et tardus, pulses alternans, pulses bisferiens etc.. as they may give a clue for underlying heart disease.

## Blood pressure:

Methods used to measure blood pressure in children:

1.Auscultatory method (sphygmomanometer)

2.Palpatory method

3.Flush method

4.Oscillometry method

5.Doppler method

**Auscultatory method**

Should be measured in all four limbs and in the sitting and lying down position comfortably with the sphygmomanometer at heart level. The blood pressure in the leg is usually 5-10 mm of Hg higher than the arm. This is due to the standing wave effect.

Appropriate cuff should be used for variable age group.

**Formulae for approximate blood pressure:**

Systolic BP = 90 + (age ×2) mm of Hg. ( 1-12 years)

Diastolic BP= 60 + age in years. (1-12 years)

**Hypertension:**

Systolic and/ or diastolic BP equal to or greater than 95$^{th}$ percentile of BP distribution.

**Pulse pressure**:

Systolic BP - Diastolic BP

Normal value 30 – 60 mm of Hg.

Pulse pressure is increased in condition with bounding pulses.

Pulse pressure is decreased in conditions with diminished pulses.

**Mean arterial pressure:**

Diastolic pressure + 1/3 of pulse pressure.

Normal value : 100 mm of Hg

# Respiration:

Rate

Tachypnoea

CCF, Pulmonary edema, large left to right shunt

Rhythm

Type of Respiration

## JVP:

Difficult to assess in infants and young children.

**Raised in**

Tricuspid Atresia , Tricuspid regurgitation, Complete heart block, Constrictive pericarditis and SVC obstruction

**Temperature:**

Raised in Infective endocarditis

Hypothermia in CCF, Shock.

**Other findings**

Pallor: can occur in infective endocarditis, also in chronic heart diseases

Icterus: occur in infective endocarditis due to destruction of RBCs.

Cyanosis : occurs in Cyanotic congenital heart diseases. Appearance of cyanosis in a left to Right shunt lesion indicates development of Eisenmengers syndrome.

Clubbing: occurs in cyanotic congenital heart disease & in infective endocarditis.

Lymphadenopathy: Fever with lymphadenopathy can be seen in Kawasaki Disease, especially deep cervical lymphadenopathy.

LOOK FOR

Joint swelling – Rheumatic fever

Rashes like erythema marginatum – Rheumatic fever

Sub cutaneous nodules in extensor surfaces of the body- Rheumatic fever

## Anthropoemetry

**Weight for height** and **Height for age** in children less than 5 years

These values are measured and plotted in the WHO standard deviation chart and the nutritional status is classified accordingly.

**BMI** and **Height for age** in children more than 5 years of age.

These values are also measured and plotted in the WHO standard deviation chart and the nutritional status of the child is classified accordingly. Infants and children with heart diseases exhibit a range of delay in growth andWeight gain. .Delay can be mild in some cases , and in some instances failure to thrive can result in permanent physical or developmental impairment. Reduced energy consumption and increased energy expenditure are the reasons here. Aggressive feedingstrategies should be employed early to prevent the permanent growth disturbances[13]

## Examination of cardio vascular system

## Inspection

Precordial bulge:

Examine from the foot end of the cot. Precordial bulge indicates right ventricular hypertrophy due to congenital heart disease.

Chest wall deformity:

Pectus excavatum, Pectus carinatum

Tracheal position:

Apical impulse:

Visible pulsations

Suprasternal pulsation indicates aneurysm of arch of aorta.

Epigastric pulsations: seen in cnditions like RVH, Tricuspid stenosis and abdominal aneurysm.

Look for any scars: may indicate previous cardiac surgery.

## Palpation:

Confirm tracheal position

Presence of tracheal tug indicates aortic arch aneurysm

Parasternal heave: Seen in RVH / LAE

**Table-8 Grading Of Parasternal Heave**

| GRADING OF PARASTERNAL HEAVE | FINDINGS |
|---|---|
| Grade I | Instant lift only, visible not palpable. |
| Grade II | Visible and palpable, obliterable. |
| Grade III | Visible and palpable, not obliterable |

Apical impulse

Locate and confirm apical impulse and the character

From birth to 3 years apical impulse seen in left $4^{th}$ intercostal space in mid clavicular line. With increasing age gradually moves into left $5^{th}$ space in most children and reaches the adult site in 4 – 5 years.

Shifted outwards in right ventricular enlargement

Shifted outwards and downwards in left ventricular enlargement.

Absent apical impulse in left side: Conditions like Dextrocardia, Pericardial effusion, Emphysema, Obesity or apical impulse under the rib.

Table-9 **Special characters of apical impulse:**

| **Character** | **Significance** |
|---|---|
| Hyperdynamic | Mitral regurgitation |
| | Aortic regurgitation |
| | PDA |
| | VSD |
| Tapping | High output state |
| | Mitral stenosis |
| Heaving | Aortic stenosis |
| | Systemic hypertension |
| | CoArctation of Aorta |
| Double apical impulse | HOCM |
| | AS with AR |
| | LBBB |
| | Left ventricular aneurysm |
| Triple or Quadruple apical impulse | HOCM |

Thrills:

Palpable vibrations of murmurs which accompany any organic murmur of grade III or more.

Table-10 **Location of thrill and clinical condition:**

| **Location** | **Significance** |
|---|---|
| Carotid thrill( systolic thrill) | Aortic stenosis |
| First aortic area(systolic thrill) | Aortic stenosis |
| Second aortic area(diastolic thrill) | Aortic regurgitation |
| Pulmonary area(systoli thrill) | Pulmonary stenosis |
| LLSB(systolic thrill) | VSD |
| Left second intercostal space(systolic thrill) | PDA |
| Mitral area(systolic thrill) | Mitral regurgitation |
| Mitral area(diastolic thrill) | Mitral stenosis |

Palpable sounds:

First sound

In mitral stenosis

Second sound

Cases with pulmonary hypertension

**Percussion:**

Left border corresponds to Apex

Right border corresponds to right border of sternum.

**Enlargement of area of dullness seen in:** Conditions like Cardiomegaly, cardiomyopathy, pericardial effusion and pulmonary artey dilatation.

.

**Auscultation:**

MITRAL AREA:

Corresponds to apex beat, close to $5^{th}$ left intercostal space

TRICUSPID AREA:

Fourth left intercostal space at lower end of sternum.

AORTIC AREA:

First aortic area: Right $2^{nd}$ intercostal space close to sternum..

Second aortic area( erbs area): Left third intercostal space close to Sternum.

PULMONARY AREA:

Second left intercostal space close to sternum

GIBSON"S AREA:

Left second intercostal space away from sternum

**Auscultate for;**

Heart sounds ( S1, S2, S3,S4.)

Murmurs

Gallops

opening snap

ejection click

pericardial rub.

FIRST HEART SOUND (S1)

Closure of Mitral and Tricuspid valve.

Loud S1:

1.Mitral stenosis

2.Tricuspid stenosis

3.ASD

4.High output state.

5.Atrial myxoma.

Soft S1:

1.Mitral regurgitation

2. Tricuspid regurgitation

3. Aortic regurgitation

4. Stenosed and Calcified mitral valve

5. Stenosed and calcified tricuspid valve

Varying intensity S1:

Atrial fibrillation

Complete heart block

SECOND HEART SOUND:

( Closure of aortic and pulmonary valve)

Loud S2:

Aortic component:

Systemic hypertension

Pulmonary component:

PDA / ASD / Large VSD.

Pulmonary hypertension

Pulmonary artery dilatation

Character and Splitting of Second heart sound:

Table-11 **Split second heart sound and significance**

| **Split** | **Significance** |
|---|---|
| Wide and fixed splitting | ASD / PS / RBBB |
| Reverse splitting | Severe AS / LBBB |
| Single S2 | |
| (Absent A 2) | Severe aortic stenosis |
| (Absent P 2) | Pulmonary stenosis |
| | Pulmonary atresia |
| | TGV , TOF , Truncus arteriosus. |

THIRD HEART SOUND:

( Produced by initial passive filling of ventricle)

Normally present in children and athletes.

Pathological S3: Seen CHDs like ASD,VSD,and PDA and regurgitant lesions like Aortic regurgitation, mitral regurgitation and tricuspid regurgitation. Also seen in high output states, HOCM, systemic and pulmonary hypertension and constrictive pericarditis.

FOURTH HEART SOUND:

( Produced by rapid emptying of atrium into ventricles in late diastole)

Always pathological

Heard in: 1.HOCM

2.Aortic or Pulmonary stenosis

3.Systemic hypertension

4.Myocardial fibrosis.

**Murmurs:**

Produced because of turbulent flow of blood through a constricted or irregular orifice or excessive flow.

Grading of murmurs( Levine and Freeman"s grading)

**Systolic murmurs**:

Grade 1: Very soft and heard in optimal conditions

Grade 2: Faint murmur but clearly audible

Grade 3: Moderately loud but no thrill

Grade 4: Loud murmur with thrill

Grade 5: Louder with thrill and can be heard away from the involved site

Grade 6 : Murmur with thrill heard even when the stethoscope lifted off .

Systolic murmurs only graded because they can be flow or physiological murmurs which are low graded. Diastolic murmurs are always pathological.

Table-12 **Characters of functional murmur and pathological murmur**

| Functional murmur | Pathological murmur |
|---|---|
| 1. No thrill | Thrill may be present |
| 2. Localized | Diffuse murmur |
| 3. Usually systolic | Systolic or diastolic |
| 4. Usually present in children | Any age |
| 5. Soft and short | Rough and blowing character |

Table-13 : **Location and timing of murmur and heart disease**

| Area | Murmur | Significance |
|---|---|---|

| | | |
|---|---|---|
| Mitral area | Mid diastolic murmur | Mitral stenosis |
| Pulmonary area | Ejection systolic murmur | TOF, ASD, Pulmonary stenosis, pulmonary hypertension. |
| First aortic area | Ejection systolic murmur | Aortic stenosis |
| Second aortic area | Early diastolic murmur | Aortic regurgitation |
| Tricuspid area | Pansystolic murmur | Tricuspid regurgitation |
| 2nd left intercostal space | Continuous murmur | PDA |
| Left 3rd and 4th intercostal | Pansystolic murmur | Ventricular septal defect |

Pitch:

High pitched murmurs heard well with the diaphragm

Low pitched murmurs heard well with the bell.

Character: May be soft, harsh, blowing, vibratory or humming in character

Rough murmurs: when blood flows through a stenosed valves

Blowing murmurs: when blood flows through a regurgitant valve.

Transmission / Conduction:

Conducted murmurs are in same intensity and same duration.

Transmitted murmurs are in decreased intensity and decreased duration.

Added sounds:

Opening snap:

Opening of atrio ventricular valve.

At apex: Mitral stenosis, MR,VSD,PDA.

At left parasternal region:

Tricuspid stenosis, Tricuspid regurgitation, ASD.

Ejection click:

Due to forcible opening of aortic cusp.

Aortic stenosis, Pulmonary stenosis.

Other system examination:

Respiratory system: Normal vesicular breath sounds

Auscultate for crackles and wheeze.

Abdomen: Palpate for hepatomegaly

Measure liver span

Splenomegaly

Central nervous system: FND

**Investigations in cardiovascular system**

X ray chest,

ECG

Echocardiogram

CBC,

ASO Titre

ESR

CRP

Throat swab culture

Blood culture

RFT

LFT

Thyroid function test

X RAY CHEST:

Situs solitus: Normal situs

Gas bubble in stomach - in left side

Liver shadow -in right side. Right dome of diaphragm is higher than left dome

Situs inversus: Gas bubble in stomach- in right side

Liver shadow - in left side

Left dome of diaphragm is higher than right dome.

Situs ambiguous: Liver in midline

Possibility of complex congenital heart diseas

Indicate the presence of right or left isomerism .

Cardiac configuration:

Apex: Down and out with rounded configuration- left ventricular enlargement

Up and rounded configuration- Right ventricular enlargement

Right heart border enlargement:

Right atrial enlargement

Left atrial enlargement:

Carinal angle 90 or more

Double shadow

Shadow in shadow of left heart border.

Heart size:

Table 14 **Cardiomegaly Definition in various Age Groups**

| **Age** | **Cardio thoracic ratio** |
|---|---|
| Neonates | >60 % |
| Infants | >55 % |
| Children | >50% |

Pulmonary vascularity:

Increased pulmonary vascularity – left to right shunt lesions

Decreased pulmonary vascularity – VSD / pulmonary atresia

Table 15 **Some specific x ray findings in heart diseases**

| Appearance | Significance |
|---|---|
| Pulmonary plethora | Large left to right shunt |
| Egg on side appearance | TGA |

| | |
|---|---|
| Figure of 8 appearance | Un obstructed TAPVC |
| Normal heart with Ground glass lungs | Obstructed TAPVC |
| Box shaped heart | Ebsteins anomaly |
| Boot shaped heart | TOF |
| Inverted 3 sign/ E Sign | Co Arctation of aorta |
| Leather bottle appearance | Pericardial effusion |
| Bat wings sign | Pulmonary edema |

**Electro cardiogram in heart diseases:**

Normal variations and related abnormalities:

1, Normal heart rate in newborn is 120-230. Resting heart rate is about 120/min at one year, 100 at 5 year, and reaches adult value by 15years[14].

2. Appearance of secondary r wave in right chest leads is normal in newborn.

3 .At birth RAD of mean QRS vector is the rule. The axis become normal by one year. So, normal or LAD is abnormal in newborn and early infancy. Seen in AV canal defect and Tricuspid atresia.

4. Dominant R wave can persists in right chest leads upto 6 months to 8 years.

5. Q waves are normally seen in lead II, III , aVF, V5, V6. If Q waves seen in other leads it is abnormal. Presence of Q waves in inferior leads is due to clockwise loop of initial vector. Can be seen in CHD. Presence of Q waves in lead I and AVL and absent in inferior leads means counterclockwise rotation. Seen in Tricuspid atresia and AV canal defect.

Deep Q waves in lateral leads may indicate anomalous origin of left coronary artery from pulmonary artery.

6. If the corrected QT interval more than 0.44 seconds it is abnormal[15]

   Prolonged QT interval: Seen in Hypokalemia, Hypothermia, Hypocalcaemia, Cerebral injury and drugs like Macrolide antibiotics, Trimethoprim and cisapride.

7 .T wave in V1 can be upright in newborn upto 7 days. Inverts after 7 days and remains upto 7 years. Upright T waves in right chest leads between 7 days to 7 years indicates right ventricular hypertrophy even though the voltage criteria is not fulfilled.

8 .Atrial and ventricular extrasystole are common and typically abolished with exercise. Also the sinus arrhythmias.

9 .Sinus pauses as long as 800 to 1000 ms is normally seen while sleeping, feeding, defecation and other times of increased vagal tone. At times, periods of junctional rhythm , i.e narrow QRS complexes without preceding P waves can be seen.

10 . Wandering pacemaker: Change in P wave axis and morphology in different beat is normal in children.

11 . Some adolescent children may show early repolarization.

12 . Premature neonates born before 28 weeks of gestation may normally show LV dominance at birth. QRS axis can be normal or leftward at birth.

**Axis deviation**:

**Left axis deviation:** Left ventricular hypertrophy, LBBB and left anterior

hemiblock.

**Right axis deviation:** Right ventricular hypertrophy, RBBB.

**Superior QRS axis:** When S wave greater than R wave in aVF. Overlap with LAD and LAHB. Seen in AV canal defect and Tricuspid atresia. Very rarely seen in normal individual[16]

**P wave abnormalities**:

P wave axis is normal in from birth due to sinus nodal origin of the impulse. Positive in both lead I and aVF. If the p wave axis is different it indicates impulse arises from ectopic site commonly seen in some CHD. Right axis deviation of P wave seen in situs inversus.

Table 16 **Atrial enlargement and Significance**

| Right atrial enlargement | Left atrial enlargement |
|---|---|
| P wave amplitude more than 2.5 mm | Terminal negative deflection is increased |

| | |
|---|---|
| Best noticed in lead II<br><br>Seen in<br>Severe pulmonary stenosis<br>Tricuspid and Pulmonary atresia<br>With intact ventricular septum. | (> 0.1 mV) and prolonged (> 40 mS)<br>Best noticed in V I<br><br>Seen in<br>PDA<br>VSD<br>Mitral atresia<br>Aorto pulmonary window |

**Analysis of PR segment:**

PR Segment reflects the time taken by the depolarization impulse to travel across the atrium and the atrioventricular node.

Prolonged in varying degree of AV Block.

Shortened in WPW syndrome, Ectopic atrial pacemaker.

**Analysis of QRS complex**:

Right bundle branch block and left bundle branch block can be seen normally. Right bundle branch block seen commonly after open heart surgeries.

**Ventricular hypertrophy**:

Right ventricular hypertrophy

Characterised by tall R wave in V1 and deep S wave in V6 and

upright T wave in precordial leads.

Seen in 1 . Pulmonary stenosis

2 . ASD.

Left ventricular hypertrophy

Characterised by tall R wave in V5 and V6 and deep S wave in V 1 associated with T wave abnormalities in V5 and V6.

LVH with Tall T waves indicates volume overload

Seen in VSD, PDA

LVH with ST depression or T inversion indicates pressure

Seen in Aortic stenosis, Co Arctation of aorta.

Katz-Wachtel phenomenon

Large amplitude equiphasic QRS complexes in mid precordial leads seen in biventricular hypertrophy.

**Cardiac position**

In levocardia chest leads shows a progressive change from dominant S wave in lead I to dominant R wave in lead V5, V6.

In dextrocardia, the normal progression of R wave is not seen. Progressive reduction in amplitude of QRS from V2 – V6.

ST segment:

ST elevation:

Early repolarization

Pericarditis

Hyperkalemia

Intra cerebral haemorrhage

Pneumothorax

Pneumopericardium

Kawasaki disease.

Anomalous left coronary artery from pulmonary artery

ST depression:

RVH in right precordial leads

LVH in left precordial leads

Analysis of T wave:

Inverted T wave

Pressure overload to ventricles

ALCAPA

Kawasaki disease with coronary involvement.

Tall T wave

Hyperkalemia

Shortened T wave

Hypokalemia

**Echocardiogram**

Evaluation of cardiac structure and function with images and recordings produced by ultrasound. Best noninvasive cost effective investigation in pediatric

cardiology.

**Other investigations (In selected cases )**

Complete blood count

Rheumatic fever

Infective endocarditis

Kawasaki disease

ASO, CRP

Rheumatic fever

Blood culture

Infective endocarditis

Throat swab culture

Rheumatic fever

Renal function test

May altered in CCF ( renal insufficiency is common in patients with heart failure and also renal insufficiency is a independent prognostic factor in heart failure)[17]

Liver function test

A spectrum of hepatic derangements can occur in heart failure particularly in right heart failure. The primary pathology is either passive congestion or low cardiac output and the consequences of impaired perfusion[18]

Thyroid function test

Pericardial effusion

## SOME COMMON PEDIATRIC HEART DISEASES

**Congenital heart diseases**:

Left to Right shunt

**1 . ASD (Atrial septal defect)**

Isolated anomaly in 5- 10 percent of CHD.

Male female ratio- 1:2

Fossa ovalis ASD: Located in the central portion of atrial septum, in the position of foramen ovale. This type is amenable to closure by cardiac catheterization. Overall most common type. (Ostium secundum type)

Sinus venosus ASD: At the junction of Superior vena cava and right atrium most commonly. (Superior vena caval type)

Ostium primum type: Due to failure to over seal the septum primum. Most commonly seen in Down's syndrome.

Coronary sinus ASD: Defect in the roof of coronary sinus.

Treatment:

Surgical closure is better done before school entry to avoid late complications. Small defects < 8 mm can be observed. Fossa ovalis with good margins may be closed percutaeneously in catheterization lab. Other defects needs surgical closure[19]

**2. VSD ( Ventricular septal defect)**

Most common form of congenital heart disease. ( 15 – 20%).

Perimembranous VSD is most common type. Other types are inlet, outlet and trabecular.

Spontaneous closure is possible in small muscular types about 30%.

Treatment: Medical treatment for CCF, RRTI, IEC, Anemia if occurs.

Surgical closure indicated in Larger defects, evidence of ventricular volume overload, progressive aortic valve diseases, infundibular defects, chamber enlargement and pulmonary arterial pressure more than 50% of systemic pressure[20]

**3.PDA(Patent ductus arteriosus)**

It is the persistence of normal fetal channel connection between aorta and pulmonary artery. Functional closure usually occurs between 12 to 24 hours. Prematurity is associated with delayed closure of PDA.

Treatment of PDA: Indomethacin and Ibubrufen can be tried in preterm infants in neonatal period. Paracetamol therapy also has promising results and analternative for PDA closure when indomethacin is contraindicated[21]

After 10 days of postnatal age the ductus rarely responds to medical therapy. Such patient need non surgical closure like coil closure and with occlusive devices.

## ACYANOTIC OBSTRUCTIVE LESIONS

AORTIC STENOSIS: Most common cause is bicuspid aortic valve. Severe forms of stenosis presents early in newborn. Less severe forms presents later in life.Supra valvular aortic stenosis is seen in association with Williams's syndrome. Symptoms include angina, syncope, dyspnea and fatigue. Risk of sudden death in adolescent and young adults is a dangerous complication.

Treatment: Pressure greadient less than 50 needs regular follow up.

1.Baloon valvuloplasty ( Isolated stenosis without aortic Regurgitation)[22] Indicated in pressure gradient more than 50 with symptoms or ST-T changes in ECG. Pressure gradient more than 75 without any symptoms.

2.Aortic valve surgery or valve replacement is indicated infailed valvuloplasty and cases associated with aortic regurgitation. Aortic valve replacement with a mechanical prosthesis or Ross surgery with pulmonary autograft are the surgical procedures[23]

CO-ARCTATION OF AORTA: 5$^{th}$ most common congenital manifestation, 6 – 8 % of congenital heart diseases. Usually manifests as a discrete constriction of the aortic isthmus. Presence of aortic arch hypoplasia is relevant in developing hypertension[24]

Clinical presentation depends upon the presence of other lesions likeVSD,PDA. Severe disease presents as collapse or shock like state in newborn after ductal closure. Infant may presnt with CCF. Adolescent may present with arterial hypertension.The hallmark of physical finding is discrepancy between upper limb and lower limb pulses and blood pressure.

Treatment: Treatment of CCF with inotropes and diuretics followed by surgical repair in newborn. Percutaneous Balloon Angioplasty and stenting. Can be done as a bridging procedure in children with CCF also[25]

Resection and End to End anastomosis and Subclavian flap repair are the most common surgical approaches. Aneurysm and rupture is most commoncomplication and this needs re intervention[26,27,28.]

PULMONARY STENOSIS: Valvular form is the common type. Other types aer sub valvular and supra valvular. In the common form the valve is thickened with fused or absent commissures. The pulmonary valve is dysplastic in noonan syndrome. Supra valvular pulmonary stenosis often refers to the narrowing of pulmonaryartery branch. Most patients are asymptomatic and well developed. Critical pulmonary stenosis presents with cyanosis and symptomatic. The symptoms are fatigue and tachypnea.

Treatment: Mild stenosis( Pressure gradient less than 50) needs yearly follow up. Moderate (pressure gradient 50 – 79) and severe stenosis(pressure gradient more than 80) needs Balloon pulmonary valvotomy. Ballon pulmonary valvotomy has excellent short term and long term outcome[29]. Surgical valvotomy is indicated in patients with dysplastic valves and severe stenosis which failed to responds to balloon valvotomy.

## COMMON CYANOTIC CONGENITAL HEART DISEASES

TETROLOGY OF FALLOT'S: The four components of TOF are VSD, Aortic override of VSD, Right ventricular outflow tract obstruction and right ventricular hypertrophy. Other associated anomalies are valvular pulmonary artery stenosis, right sided aortic arch and ASD. 5% cases have an anomalous origin of left anterior descending artery from right coronary artery. Clinical severity of TOF varies with degree of pulmonary stenosis. With mild obstruction systolic murmur is the only presenting symptom known as pink tetrology. With severe obstruction patient presents with Cyanosis. During a spell the

murmur is usually not heard due to blood flow mainly through Large VSD (non restrictive VSD) instead of going through right ventricular outflow tract[30]

TET spell is managed with knee chest position, calm the child, supplemental oxygen, intra muscular ketamine or intravenous or subcutaneous morphine. Severe cases may need sub cutaneous or intravenous phenylephrine or intravenous propranolol. Intubation and mechanical ventilation is next option followed by emergency BLALOCK TAUSSING shunt or complete repair[31]

Treatment:

Treatment of TET spell

Surgical correction accomplished by patch closure of VSD and Right ventricular muscle resection with or without pulmonary valvotomy.

Cases with anomalous left coronary artery may need temporary BLALOCK TAUSSING shunt followed by more complicated intra cardiac repair and takedown of shunt.

**TRANSPOSITION OF GREAT ARTERIES**: Aorta and pulmonary artery arising from wrong ventricles leading to deoxygenated blood in systemic circulation andoxygenated blood back to lungs. VSD is the common associated anomaly in 25% cases.Newborn with intact VSD presents with severe cyanosis within 24 hours of life. Reverse differential cyanosis is the hallmark of TGA with intact septum. Other Presentations in TGV is failure to thrive and CCF.

Treatment: Arterial switch operation is the corrective surgery. In addition coronary artery must be moved to the new aortic root. Most successful when performed age less than 2 weeks. If the diagnosis is made late then atrial switch operation ( Mustard and Senning ) may be performed. Rastelli operation is the procedure of choice when

TGA is complicated with pulmonary artery stenosis or left ventricular outflow tract obstruction and a VSD[32,33]

**TOTAL ANAMOLOUS PULMONARY VENOUS RETURN**: All the pulmonary veins drains to systemic veins or the right atrium instead of draining to left atrium. The obstructive type of TAPVR presents within few hours of life with cyanosis and respiratory distress and the cyanosis never responds to any nonsurgical intervention.The unobstructed type presents in neonatal period or infantile prriod with CCF, RRTIand FTT.

Treatment: Reanastomosis of pulmonary venous confluence to the posterior wall of the left atrium is choice.

## COMMON ACQUIRED HEART DISEASES IN CHILDREN

### 1.RHEUMATIC FEVER

Disease which licks the joint, bites the heart and stings the brain. It is delayed, non suppurative inflammatory sequel of upper respiratory infection due to group A beta hemolytic streptococci. Usual strains are type 1,3,6.18 and 49. Immune molecular theory is the accepted pathogenesis.

Clinically presents with acute fever, arthritis , carditis with CCF or be silent with silent carditis. Most of the children report a previous sore throat.

Best diagnosed by Jone's criteria. This Jone's criteria is revised latest by WHO in 2015. The guidelines consists of major, minor and essential criteria. Presence of two major or one major and two minor criteria are required in the presence of essential criteria.

Major criteria: 1.CARDITIS: Most specific of all criteria. Usually

pancarditis. Carditis occurs in 30 – 90% of acute rheumatic fever. The only cardiac manifestation of acute rheumatic fever. It is an early manifestation. Develops within 2 weeks of onset of rheumatic fever.

2.ARTHRITIS: Is a fleeting type of poly arthritis, usually involves larger joints like knee, ankle and elbows. Typically migratory in character. Early manifestation. Joints have redness, warmth, swelling and restriction of movements but no residual damages.

3.SUBCUTANEOUS NODULES: These are non tender, non adhesive nodules of varying size from pin head to an almond on body prominences like shin, wrist, elbow, knee, ankle, spine and occiput. These are late manifestations, occurs after 6 weeks of acute rheumatic fever and patients with nodules always have carditis.Persistence of nodules associated with chronic carditis.

4.ERYTHEMA MARGINATUM: Reddish rash, non raised above the skin and non itchingwith serpigenous margins. Very specific to rheumatic fever but rare in India , due to dark skin complexion.

5.CHOREA: Characterized by purposeless jerky movementsresulting in abnormal speech, muscular incoordination, dropping of articles,awkward gait and weekness. Emotional liability is also there. More common in females. It is a latemanifestation and self limiting.

Minor criteria

1. FEVER: More than 90% have fever , usually goes upto 39.5 deg C.
2. ARTHRALGIA: Subjective joint pains without physical signs.
3. History of previous rheumatic fever or RHD.
4. LABORATORY FINDINGS: Elevated ESR, or Elevated CRP or Elevated WBC count. Prolonged PR interval in ECG.

ESSENTIAL CRITERIA: Recent evidence of streptococcal infection

1.Increased antibodies against streptococci Anti DNAse antibody, Antihyaluranidase antibody, Streptozyme antibody and a rising titre of ASO titre.

2. Positive throat culture for streptococci

3. hiotory of recent scarlet fever.

TREATMENT OF RHEUMATIC FEVER:

1. Bed rest till active carditis settles, Immoblization may be continued for 2 – 3 months in case of CCF.

2. Easily digestible nutritious diet with vitamins, salt restriction in case of CCF.

3. Antimicrobial therapy: PENICILLIN Procaine penicillin 4 lakhs units intramuscularly twice daily for 10 days. Followed by prophylactic benzathine penicillin once in 21 days. Patients sensitive to pecillin can be managed with Erythromycin.

4. Suppressive therapy: With carditis and CCF give steroids and aspirin.With carditis and no CCF give steroids or aspirin. With no carditis and no CCF give aspirin.

2. CHRONIC RHEUMATIC HEART DISEASES: Around 20 – 25% of cases in pediatric cardiac outpatient clinic is chronic RHD, resulting in crippling valvular heart diseases. Mitral valve is most commonly involved. Regurgitant is the most common lesion. May be combined stenosis and regurgitant. Combined aortic and mitral valve diseases also can be seen. Isolated aortic valve disease is rare. Isolated tricuspid valve disease does not occur.

3.KAWASAKI DISEASE: A febrile oculo oro cutaeneo acro desquamatous syndrome with or without acute nonsuppurative cervical lymphadenitis.

Clinically presents in infants and young children less than 5years. Second common acquired heart disease in children.

AHA Criteria for diagnosis of KAWASAKI diseases

1. Fever,
2. Red palm and sole with indurative edema, .desquamation of fingers, toes , sole and palms,
3. Polymorphus exanthema,
4. Bilateral non purulent conjuctival congestion ,
5. Oral mucosal changes and
6. Acute non suppurative cervical lymphadenopathy.

Presence of five above features or four features with echocardiographic coronary artery lesions leads to diagnosis.

TREATMENT: Intravenous immunoglobulin 2 gram per kg over 12 hours.

Aspirin 100 mg/ kg in four divided doses for 5-7 days.

Subsequently Aspirin 5mg/ kg /day, Once daily for 6-8 weeks.

Plasma exchange in refractory cases.

Ulinastatain: A human trypsin inhibitor tried in immunoglobin refractory Cases.

Abciximab,TPA, Streptokinase can be used in acute coronary events in KD.

Infliximab: TNF α antagonist is used in resistant KD.

Cyclosporin can be used in IV immunoglobin failed cases in KD.

4.CARDIOMYOPATHY:

Group of diseases of heart muscles not secondary to structural heart diseases or hypertension or pulmonary vascular diseases. Characterized by abnormality of systolic and or diastolic function.

Types: 1.Dilated

2,Hypertrophic

3.Restrictive.

Dilated cardiomyopathy is common type of cardiomyopathy in children, in which both ventricles are dilated with reduced contractility. Idiopathic – most common cause. Other major causes are viral myocarditis, autoimmune and genetic.

COMPLICATIONS OF HEART DISEASES IN CHILDREN:

1.CCF

2.PULMONARY HYPERTENSION

3.INFECTIVE ENDOCARDITIS.

4.GROWTH RETARDATION.

MANAGEMENT OF CCF IN CHILDREN[34]

General measures:

1.Feeding with calorie dense dietary preparation

2. Bed rest, water and salt restriction

3. Providing respiratory vaccines (H.influenza, pneumococcus, DPT, Influenza),

4.Periodic monitoring.

Drugs:

1. Diuretics including spironolactone
2. Digoxin
3. ACE Inhibitors
4. Carnitine mainly used in cardiomyopathy.
5. Betablockers

Surgical management

# AIM OF THE STUDY

## Aim of the study

To study the pattern of heart disease in children aged 1 MONTH to 12 years in Govt. Theni Medical College

## Objectives

1. To study the types of heart disease in children aged 1 MONTH to 12 years

2.To assess the pattern, age and gender specific distribution of congenital and acquired heart diseases

3.To study the complications associated with various types of heart diseases.

# REVIEW OF LITERATURE

## REVIEW OF LITERATURE

In a study, done by,Khurshid Ahmed Wanni, Naveed shahzad, Mohd Asraf, Muzafer Jan, Shafaqat rasool at Jammu and Kashmir ,India , the prevalence of CHD was about 1.12 per 1000 population. Acyanotic lesion was the commonest(88.6%), among which VSD was the most common lesion. Most common age of presentation was 2 months to 1 year. Next common lesion was PDA which commonly occurred under 1 month of age. ASD was the third common lesion and common age group was12month to 1 year. Among the cyanotic CHD the commonest lesion was TOF followed by TGV. Age group in cyanotic CHD was 2 months to 1year and under 1 month for TOF and TGV respectively . In this study all the lesions were common in male children[35]

Mukul Misra et al study stated that prevalence of congenital heart disease in school children was about 1.3 per 1000 population. Prevalence of Rheumatic heart disease was 0.5% per 1000 population. The commonest lesion was VSD, followed by ASD[36]

In another Indian study at Mumbai in children under 12 years of age,done by Sonali tank, Sushma Malik and SurekhaJoshi ,they reported that in all age groups of Children,males were more affected than the female children by CHD. Breathlessness was the most common presenting symptom followed by Lower Respiratory Tract Infection. The most common lesion was VSD followed by ASD in acyanotic group. Among the cyanotic group, TOF was the most common ,followed by TGV. Breathlessness was the most common symptom in both group. Failure to thrive was seen in 38.77 % of cases.

Among the CCF 40% of cases resulted from VSD. They also stated that TGA and left sided obstructive lesions were common in boys and ASD , VSD, PDA and PS were common in girls. This study also stated that most common age group of presentation was 1 month to 1 year followed by 1year to 5 years[37]

Another study conducted in Rajasthan by Ashok Kumar Meena, Devendra Kumar Agrawal and Renu Agrawal, stated that majority of patients with CHD wereunder 1 year of age and the male: female ratio was 1.4:1. Most common presentation was respiratory tract infection and breathlessness followed by poor weight gain. 88.9% were acyanotic and 11.1 % were cyanotic. VSD was the most common lesion followed byASD and PDA. Among cyanotic group TOF was the common. It also stated that 52.6% of patients showed severe malnutrition[38]

Another Indian study conduted by Nowneeth Kumar Bhat, Minakshi Dhar and Ritesh Kumar in Uttharkhand showed that prevalence of CHD in children was 8.4 per 1000 population. Most common lesion was VSD followed by ASD, PDA,PS and TOF respectively[39]

In Maharastra, a study done by Bhushan Deo, Jeyashree Jadhav, Nitin Idgampalli, Neeta showed that male children were affected more than female children and children under 1 month of age were more frequently affected followed by children in the age group of 1-5 years. They also showed that 8.33% of patients had family history ofheart diseases. They showed 33.33% patients had consanguinous parents[40]

Nadia mohammed and Salma sheikh and Heman Das reported in their Study which was done in children under 5 years of age at Liaquat university hospital ,Hyderabad, Pakistan that 89.3% had CHD and 10.7% had acquired cardiac diseases. 74 % were acyanotic lesions and VSD was the commonest lesion. 295 patients presented with RRTI and the other symptom was breathlessness. 35% patients were asymptomatic and identified incidentally on physical examination. Among the VSD perimembranous was the commonest type. Among the cyanotic heart diseases TOF was the common lesion and commonest symptom was breathlessness and tet spell. 40% of cyanotic heart disease had severe malnutrition. Among the acquired heart disease 93.8% had myocarditis[41]

In a study under 12 years of age , done by Kalimuddin at National Institute of Cardiovascular Diseases in Karachi, reported that 71.6% had CHD and 9.4% had Rheumatic heart diseases. Among the CHD, the most common lesion was VSD followed by ASD in acyanotic group and TOF followed by TGA in cyanotic group. Among the acquired heart diseases, Rheumatic heart disease was the commonest among which Mitral regurgitation was the most common lesion followed by combined mitral stenosis and mitral regurgitation[42].

In Cameroon , a study Chelo D et al stated that, CHD was identified in 73.8% of patients against 25.85% of Acquired heart diseases and 0.4 % with combination of both. CHD was dominated by VSD. Acquired heart disease was dominated by Rheumatic heart diseases. Breathlessness was the most frequent presenting symptom and systolic murmur was the most common sign. Mean age for CHD was 9

months and 132 months for acquired heart disease[43]

In another foreign study done by Neil Kennedy and Paul Miller at Malawi, reported that among the cardiac cases in children 55.6% were CHD and 44.4% were acquired cardiac cases. Among the CHDs , VSD predominated and among acquired ,Rheumatic heart disease followed by Dilated cardiomyopathy predominated. The mean age for VSD was 3 years 2 months and for rheumatic heart disease,11 years and 6 months .The mean age was much later than in other studies[44]

Another study in Nigeria, done by UM Sani, H Ahmed, reported that the prevalence of acquired heart disease was about 2.9%. Male : female ratio was 1.2: 1. RHD was the commonest one followed by DCM/MYOCARDITIS. Children over 10 years were mostly affected by RF/RHD. Children 1-5 years of age were affected by DCM / Myocarditis. Kawasaki disease was reported in 2 cases. Mitral regurgitation with aortic regurgitation was the most frequent lesion followed by mitral regurgitation.[45]

# METHODOLOGY

# METHODOLOGY

This is a descriptive study of one year duration conducted in the Paediatric department of Theni Medical College Hospital

Chidren of either sex from 1 MONTH to 12 years of age having clinical suspicion of heart disease are enrolled for echocardiogram to confirm the diagnosis Clinical suspicion is based on history of recurrent respiratory tract infections, presence of cyanosis, clubbing, cardiac failure, failure to thrive and in asymptomatic patients, by the presence of murmur.

The lesions are categorised by echocardiography as

1. Congenital heart disease (ventricular septal defect, atrial septal defect, Tetrology of fallot, patent ductus arteriosus, pulmonary stenosis etc)

2. Acquired heart disease (rheumatic heart disease, infective endocarditis, myocarditis, pericardial effusion Echocardiography is done using the M-mode, two dimensional and color doppler, pulse and continuous wave Echocardiogram.

Congenital heart disease is diagnosed by any gross structural abnormality of the heart or intrathoracic blood vessels that is of functional significance excluding the systemic great arteries and veins.

Acquired heart disease is diagnosed using parameters like mitral valve area, thickening of leaflets,left atrial diameter, aortic root diameter, IVSd, IVSs, left

ventricular internal diameter in diastole and systole, EF and fractional shortening

Complete blood count, ECG and X Ray chest are performed in all patients

Cardiac enzymes, thyroid profile and serum electrolytes are done in selected patients as and when required

## INCLUSION CRITERIA

Children aged 1 MONTH to 12 years with confirmed heart disease by echocardiography

## EXCLUSION CRITERIA

Cardiac failure due to anaemia

Cardiac failure in PEM

Arrhythmias with no structural heart disease

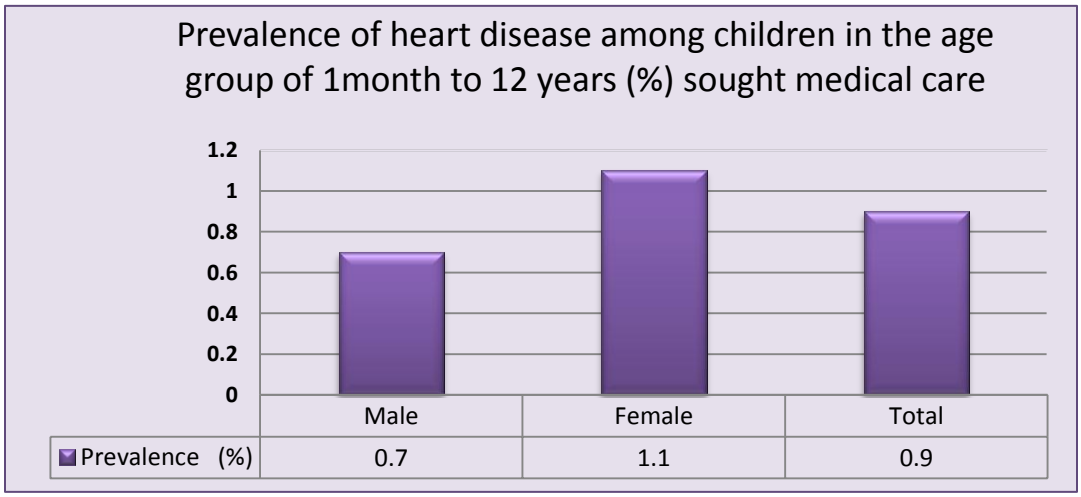
# RESULTS AND OBSERVATIONS

## RESULTS AND OBSERVATIONS

During the period of July 2015 to June 2016, a total of 24,980 patients sought medical care in the Paediatric OPD in Theni Medical College Hospital among whom 226 children in the age group of 1 month to 12 years were diagnosed with heart disease. The prevalence of heart disease was 0.9% in this study. This value cannot be extrapolated to the normal population, as the study was carried out only in a proportion of the population which sought medical care in a tertiary hospital, and neonates with heart disease were not included in the study

**Prevalence of heart disease among children in the age group of 1month to 12 years who sought health care at Theni medical college hospital during the year July 2015 to June 2016. Table: 17**

| Sex of child | No. of children with heart disease | Total no. of children attended OPD | Prevalence (%) | Prevalence 95% CI |
|---|---|---|---|---|
| **Male** | 93 | 13324 | 0.7 | 0.6 to 0.9 |
| **Female** | 133 | 11656 | 1.1 | 1.0 to 1.3 |
| **Total** | 226 | 24980 | 0.9 | 0.8 to 1.0 |



A total of 226 patients in the age group of 1 month to 12 years with a confirmed diagnosis of heart disease were included in the study, of which 93 patients were male (41%) and 133 were female(59%), with a male- female ratio of 0.7:1. Of the total number of cases, 86% had congenital heart disease and 14% were diagnosed with acquired lesions. Of the 195 cases of CHD, 177(91%) had acyanotic and 18 (9%)had cyanotic heart disease.

Table:18 **AGE DISTRIBUTION OF HEART DISEASE**

| AGE GROUP | NO OF PATIENTS WITH HEART DISEASE | PERCENTAGE | 95% CONFIDENCE INTERVAL |
|---|---|---|---|
| < 1 year | 66 | 29.2% | 23.6 to 35.4 |
| 1 to 3 years | 26 | 11.5% | 7.8 to 16.2 |
| 3 to 5 years | 16 | 7.1% | 4.2 to 11 |
| 5 to 12 years | 118 | 52.2% | 45.7 to 58.7 |

Maximum number of cases presented during school age, i.e., 5-12 years (118), followed by the infantile period, i.e less than 1 year(66).

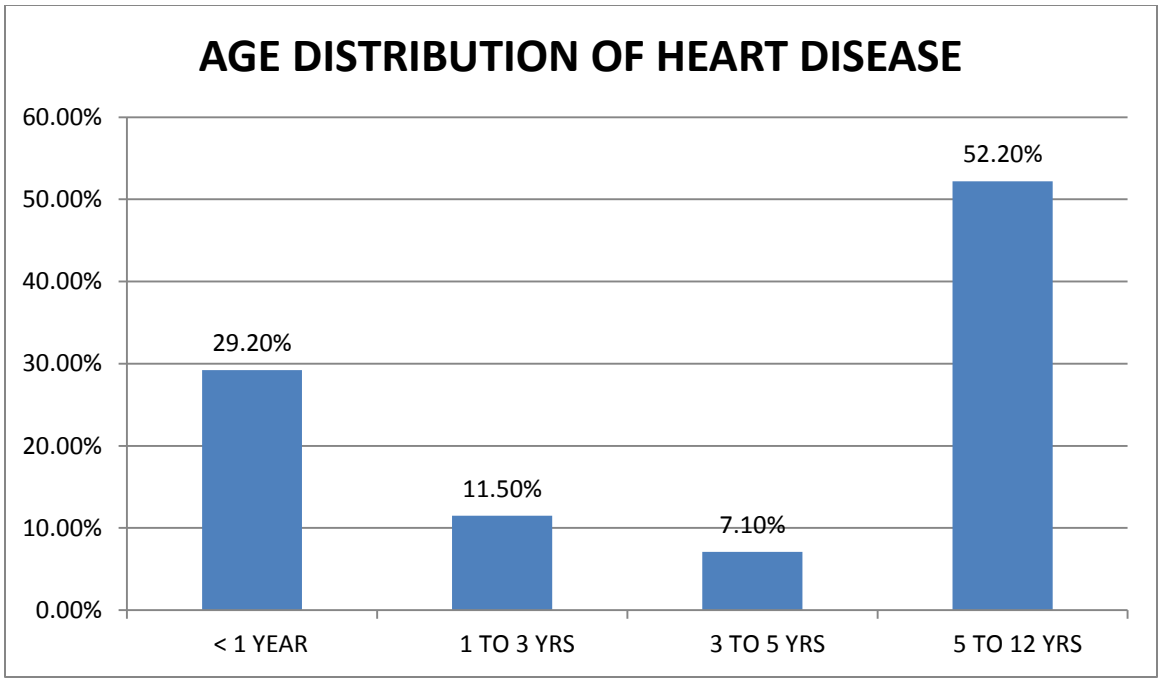
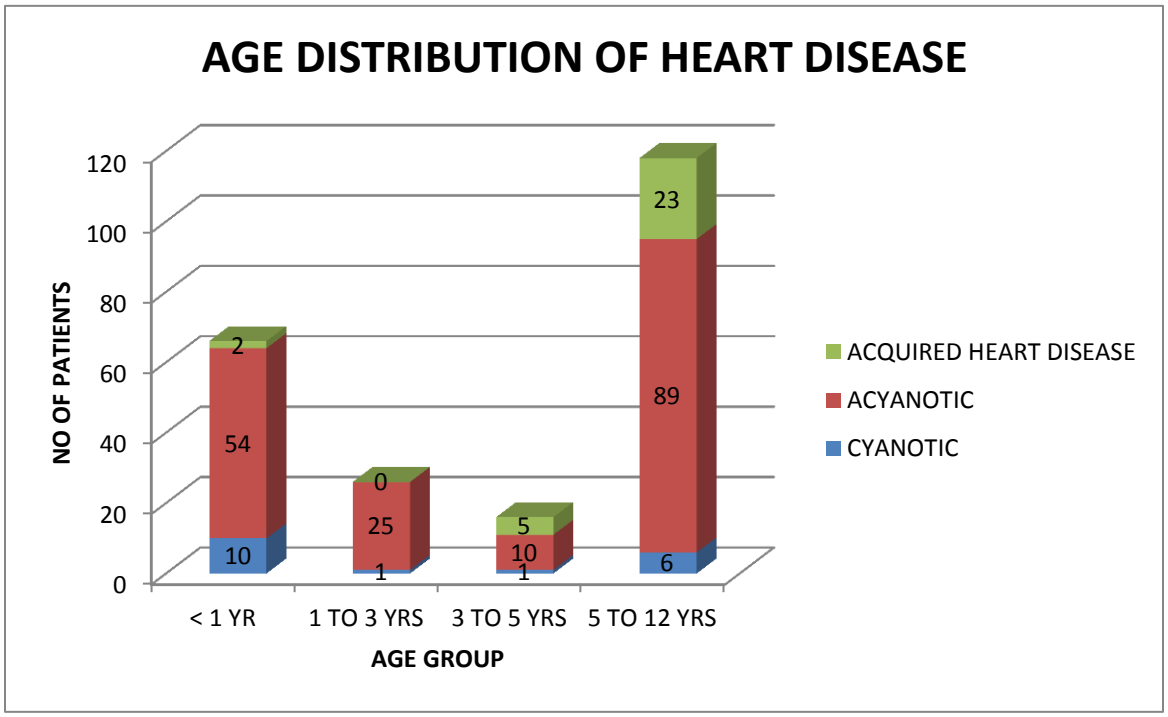


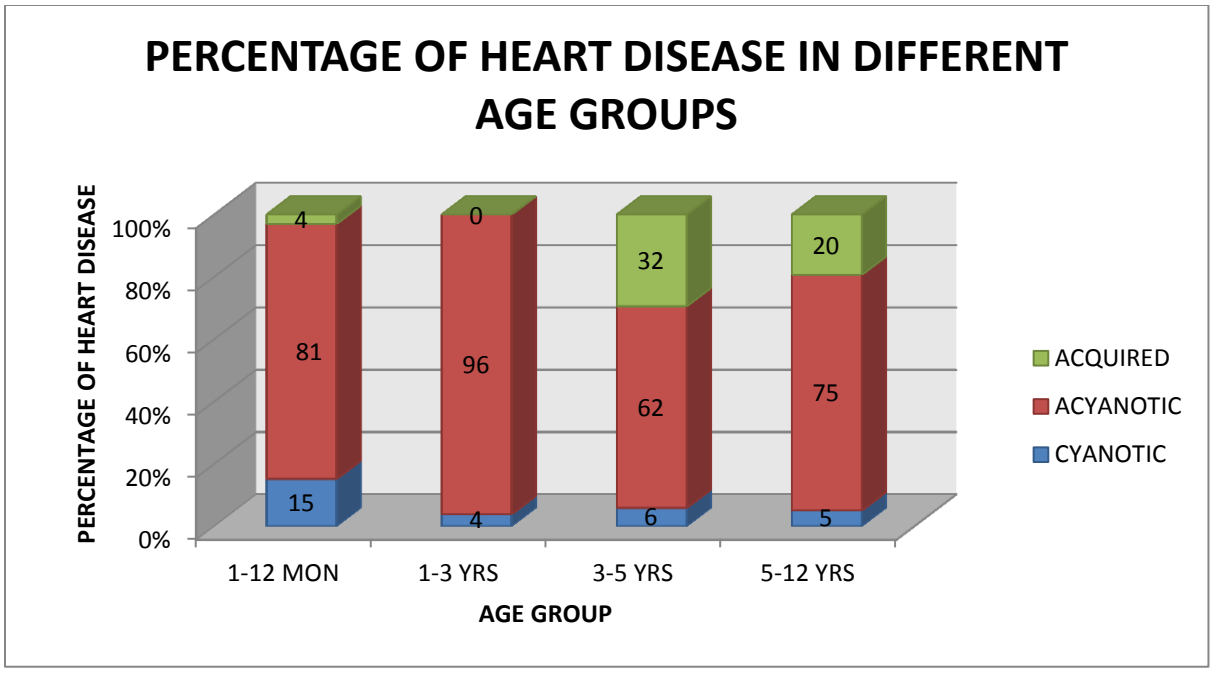

Table: 19 **Distribution of heart disease in different age groups**

| Age group | Congenital heart disease | | Acquired heart disease |
|---|---|---|---|
| | Acyanotic | Cyanotic | |
| < 1 year | 54(81%) | 10(15%) | 2(4%) |
| 1 to3 years | 25(96%) | 1(4%) | 0 |
| 3 to 5 years | 10(62%) | 1(6%) | 5(32%) |
| 5 to 12 years | 89(75%) | 6(5%) | 23(20%) |

Acyanotic heart disease comprises the majority of lesions in all the age groups. Cyanotic heart disease commonly presented in the infantile period. There is a striking rise in acquired heart disease during the preschool and school age. Acquired heart diseases are the second most common lesions in the age group of 3-5 years and 5-12 years.




Almost 51% of children with acyanotic heart disease were identified in the age group of 5 to 12 years, and 31% were diagnosed within 1 year of age. 56% of children with cyanotic heart disease were identified within 1 year of age and 33% in the age group of 5 to 12 years. Among the 6 cyanotic heart disease patients in the age group of 5 to 12 years, 2 had been diagnosed already and got operated. 74% of the acquired heart diseases were diagnosed in the school going age(5-12 years), and 16% of them were diagnosed in the preschool age(3-5 years).




Of the total number of cases, 86% had congenital heart disease and 14% were diagnosed with acquired lesions. Of the 195 cases of CHD, 177(91%) had acyanotic and 18 (9%) had cyanotic heart disease. VSD was the commonest acyanotic lesion, followed by ASD Osteum secundum type and PDA. TOF constituted 61% of the cyanotic heart diseases. TGV and TAPVC were the next commonest (11%). Complex heart diseases constituted 4% of the acyanotic heart disease. Pulmonary stenosis was the commonest obstructive cardiac lesion(7%),followed by bicuspid aortic valve(5%) and HOCM(1%). Among the 4 cases of pulmonary stenosis, 1 had peripheral PS and the remaining 13 had valvular PS.

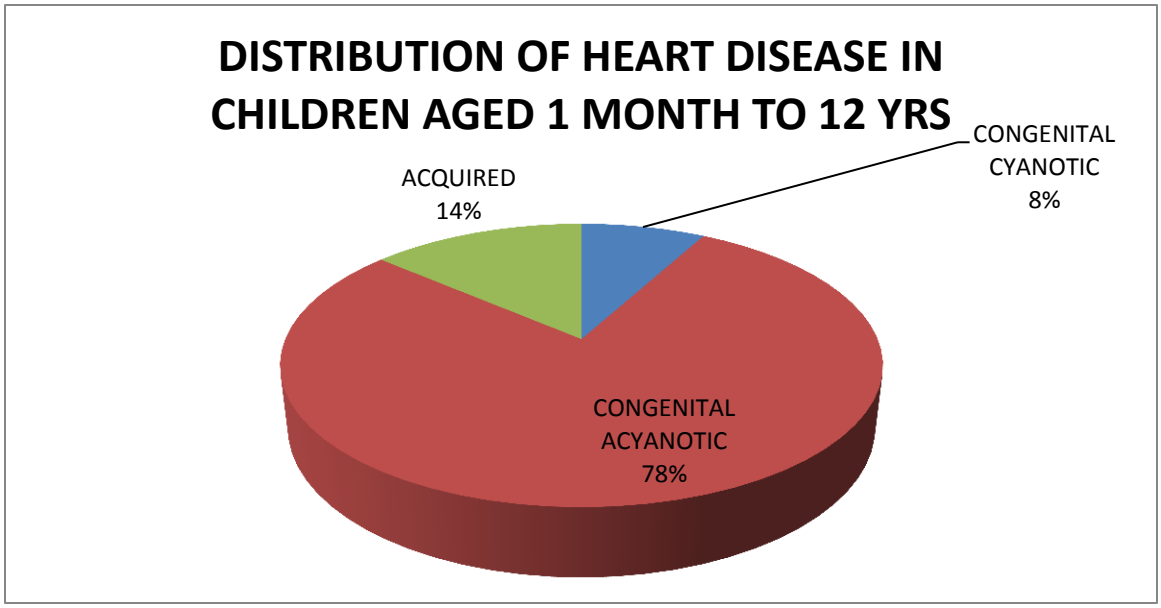
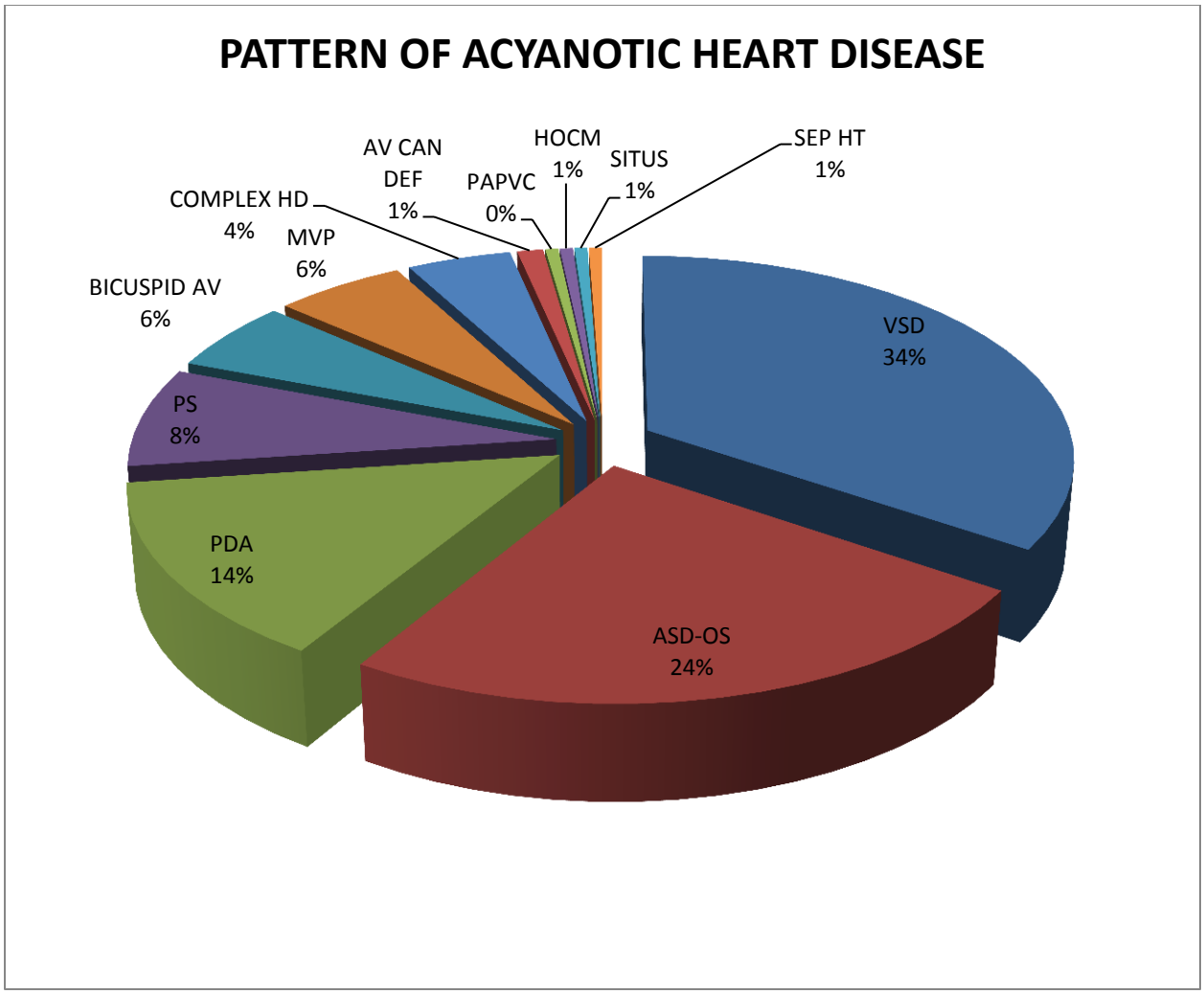


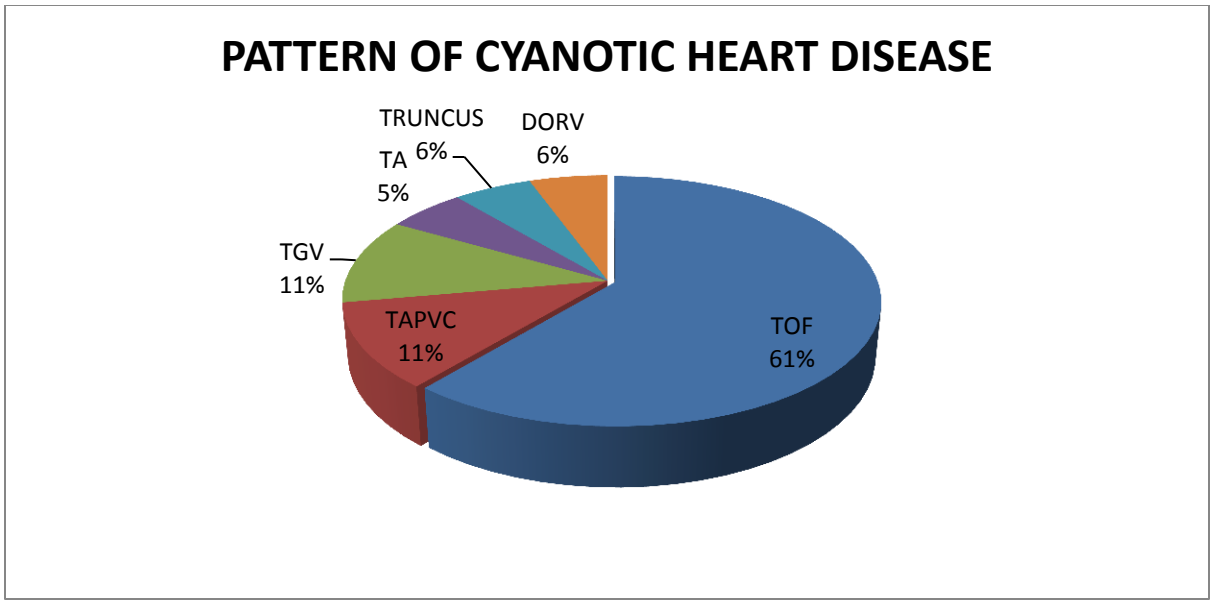

Table:20 **DISTRIBUTION OF CONGENITAL HEART DISEASE**

| **Type of congenital heart disease** | **No of patients** | **Percentage of heart disease** |
|---|---|---|
| | | |
| VSD | 61 | 31 |
| ASD-OS | 43 | 22 |
| PDA | 25 | 13 |
| PS | 14 | 7 |
| BAV | 10 | 5 |
| MVP | 10 | 5 |
| Complex heart disease | 8 | 4 |
| AV canal defect | 2 | 1 |
| PAPVC | 1 | 0.5 |
| HOCM | 1 | 0.5 |
| Situs inversus | 1 | 0.5 |
| Septal hypertrophy | 1 | 0.5 |
| TOF | 11 | 6 |
| TAPVC | 2 | 1 |
| TGV | 2 | 1 |
| DORV | 1 | 0.5 |
| Tricuspid atresia | 1 | 0.5 |
| Truncus arteriosus | 1 | 0.5 |


PATTERN OF ACYANOTIC HEART DISEASE
VSD 34%
ASD-OS 24%
PDA 14%
PS 8%
BICUSPID AV 6%
MVP 6%
COMPLEX HD 4%
AV CAN DEF 1%
PAPVC 0%
HOCM 1%
SITUS 1%
SEP HT 1%

**Age & sex distribution and clinical pattern among 178 congenital acyanotic heart disease children (subgroup within total 226 confirmed heart diseases) treated at Theni medical college hospital during the year July 2015 to June 2016.** TABLE:21

| Main variable | Variable subtype | Number | Percentage | 95% CI |
|---|---|---|---|---|
| **Age** | Infants (0-1 year) | 54 | 30.3 | 23.9 to 37.4 |
| | Toddler (1-3 years) | 25 | 14 | 9.3 to 20.0 |
| | Pre School (3-5 years) | 10 | 5.6 | 2.9 to 10.1 |
| | School (5-12 years) | 89 | 50 | 42.7 to 57.3 |
| **Sex** | Male | 71 | 39.9 | 32.9 to 47.2 |
| | Female | 107 | 60.1 | 52.8 to 67.1 |
| **Predominant symptom** | Asymptomatic | 120 | 67.4 | 60.3 to 74 |
| | RRTI | 20 | 11.2 | 7.2 to 16.5 |
| | Breathlessness | 15 | 8.4 | 5.0 to 13.2 |
| | FTT | 12 | 6.7 | 3.7 to 11.2 |
| | Chest pain | 6 | 3.4 | 1.4 to 6.9 |
| | Palpitation | 5 | 2.8 | 1.0 to 6.1 |
| **Murmur** | Systolic | 164 | 92.1 | 87.4 to 95.5 |
| | Diastolic | 0 | 0 | 0 to 1.7 |
| | No | 14 | 7.9 | 4.5 to 12.6 |
| | Both | 0 | 0 | 0 to 1.7 |
| **Cardiomegaly** | | 47 | 26.4 | 20.3 to 33.3 |
| **Abnormal ECG** | | 74 | 41.6 | 34.5 to 48.9 |
| | LVH | 16 | 9 | 5.4 to 13.9 |
| | RVH | 12 | 6.7 | 3.7 to 11.2 |
| | BVH | 14 | 7.9 | 4.5 to 12.6 |
| | RAD | 20 | 11.2 | 7.2 to 16.5 |
| | Others | 12 | 6.7 | 3.7 to 11.2 |



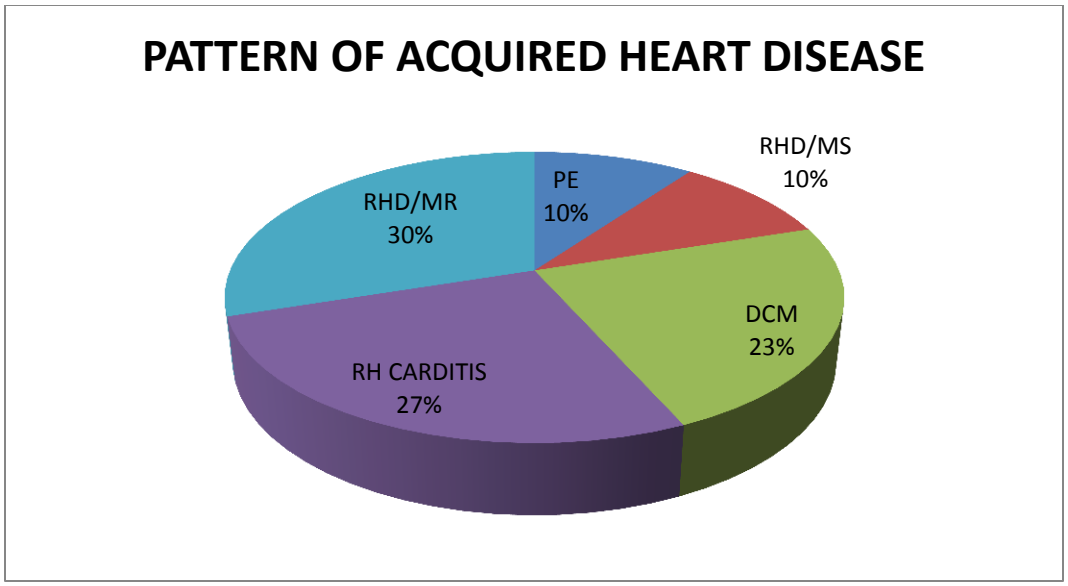

**Age & sex distribution and clinical pattern among 18 congenital cyanotic heart disease children (subgroup within total 226 confirmed heart diseases) treated at Theni medical college hospital during the year July 2015 to June 2016. TABLE:22**

| Main variable | Variable subtype | Number | Percentage | 95% CI |
|---|---|---|---|---|
| **Age** | Infants (0-1 year) | 10 | 55.6 | 32.6 to 76.8 |
| | Toddler (1-3 years) | 1 | 5.6 | 0.3 to 24.5 |
| | Pre School (3-5 years) | 1 | 5.6 | 0.3 to 24.5 |
| | School (5-12 years) | 6 | 33.3 | 14.8 to 56.9 |
| **Sex** | Male | 9 | 50 | 27.8 to 72.2 |
| | Female | 9 | 50 | 27.8 to 72.2 |
| **Predominant symptom** | | | | |
| | Breathlessness | 6 | 33.3 | 14.8 to 56.9 |
| | Cyanosis | 6 | 33.3 | 14.8 to 56.9 |
| | FTT | 6 | 33.3 | 14.8 to 56.9 |
| **Murmur** | Systolic | 12 | 66.7 | 43.1 to 85.2 |
| | Diastolic | 0 | 0 | 0 to 15.3 |
| | No | 6 | 33.3 | 14.8 to 56.9 |
| | Both | 0 | 0 | 0 to 15.3 |
| **Cardiomegaly** | | 8 | 44.4 | 23.2 to 67.3 |
| **Abnormal ECG** | | 13 | 72.2 | 48.7 to 89.0 |
| | RVH | 7 | 38.9 | 18.9 to 62.3 |
| | RVH/RAD | 3 | 16.7 | 4.4 to 39.0 |
| | Others | 3 | 16.7 | 4.4 to 39.0 |

Among the children with acquired heart disease, the commonest lesion was mitral regurgitation due to rheumatic heart disease (30%), followed by rheumatic carditis(27%) and dilated cardiomyopathy(22%). Pericardial effusion and Rheumatic mitral stenosis constituted 10% each of the total acquired heart diseases.

Table:23 **DISTRIBUTION OF ACQUIRED HEART DISEASE**

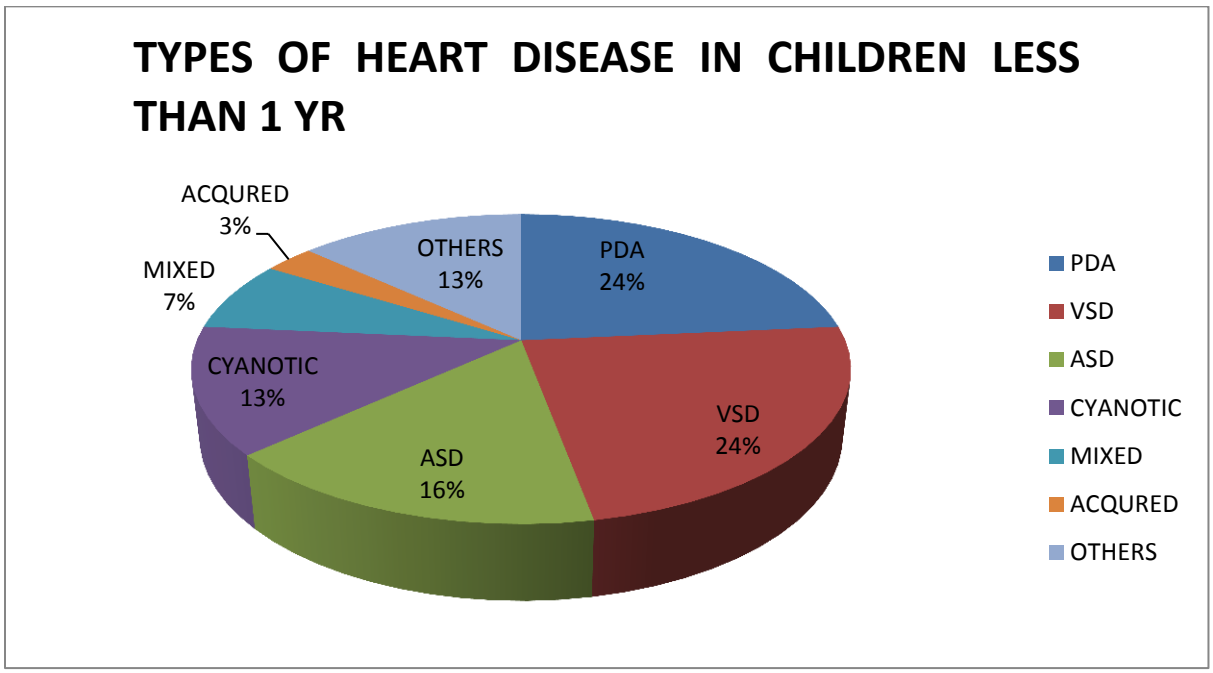
| **TYPE OF ACQUIRED HEART DISEASE** | **NO OF PATIENTS** | **PERCENTAGE OF HEART DISEASE** |
|---|---|---|
| Rheumatic carditis | 8 | 27 |
| RHD(MR) | 9 | 30 |
| Dilated cardiomyopathy(post viral) | 6 | 22 |
| Pericardial effusion | 3 | 10 |
| RHD/MR/MS | 3 | 10 |
| Myocarditis | 1 | 1 |



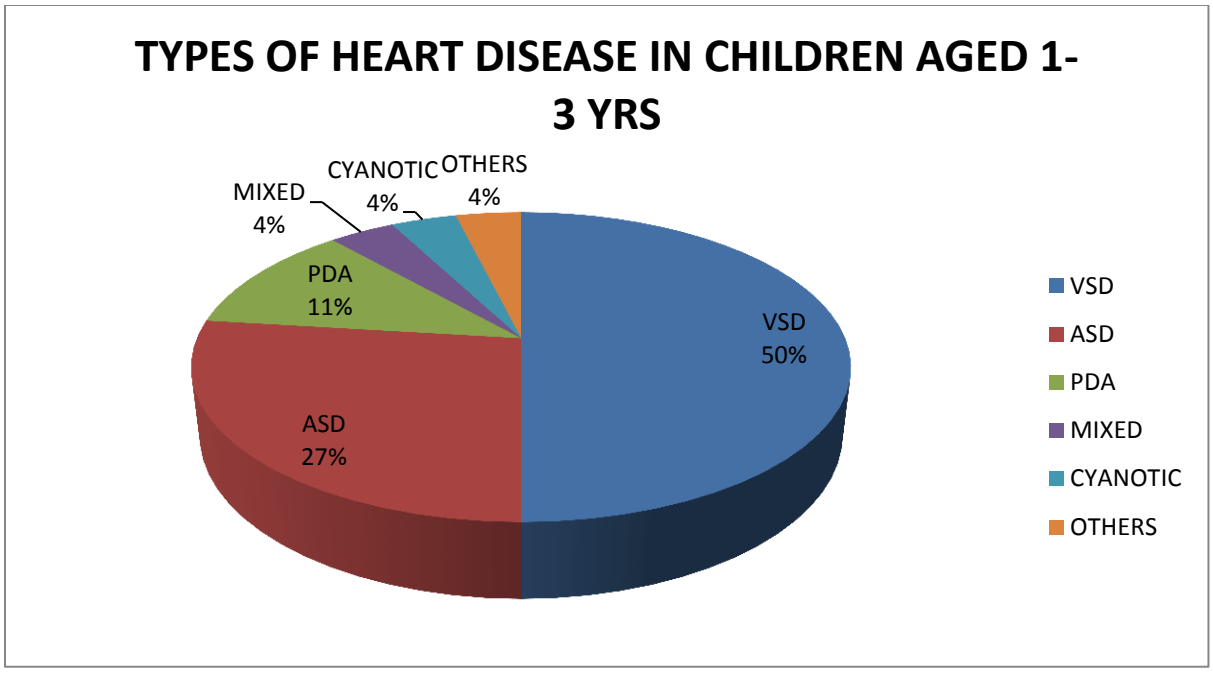

**Age & sex distribution and clinical pattern observed among 30 acquired heart disease children (subgroup within total 226 confirmed heart diseases) treated at Theni medical college hospital during the year July 2015 to June 2016.** TABLE 24

| Main variable | Variable subtype | Number | Percentage | 95% CI |
|---|---|---|---|---|
| **Age** | Infants (0-1 year) | 2 | 6.7 | 1.1 to 20.3 |
| | Toddler (1-3 years) | 0 | 0 | 0 to 9.5 |
| | Pre School (3-5 years) | 5 | 16.6 | 6.4 to 33.1 |
| | School (5-12 years) | 23 | 76.7 | 59.2 to 89.2 |
| **Sex** | Male | 13 | 43.3 | 26.6 to 61.3 |
| | Female | 17 | 56.7 | 38.7 to 73.4 |
| **Predominant symptom** | Breathlessness | 22 | 73.3 | 55.6 to 86.8 |
| | Asymptomatic | 5 | 16.6 | 6.4 to 33.1 |
| | Others | 3 | 10 | 2.6 to 24.9 |
| **Murmur** | Systolic | 18 | 60 | 41.9 to 76.2 |
| | Diastolic | 2 | 6.7 | 1.1 to 20.3 |
| | No | 9 | 30 | 15.7 to 47.9 |
| | Both | 1 | 3.3 | 0.2 to 15.4 |
| **Cardiomegaly** | | 25 | 83.3 | 66.9 to 93.6 |
| **Abnormal ECG** | | 24 | 80 | 63.0 to 91.5 |
| | LVH | 10 | 33.3 | 18.3 to 51.4 |
| | BVH | 7 | 23.3 | 10.8 to 40.8 |
| | Others | 7 | 23.3 | 10.8 to 40.8 |

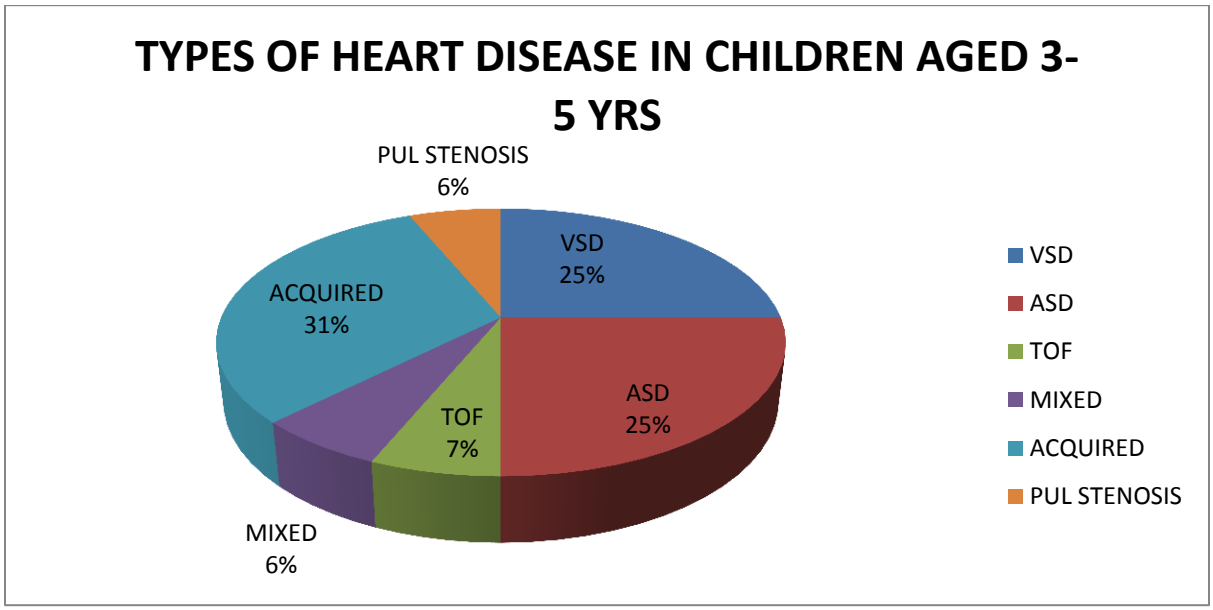
**PRESENTATION OF VARIOUS TYPES OF HEART DISEASE IN DIFFERENT AGE GROUPS**

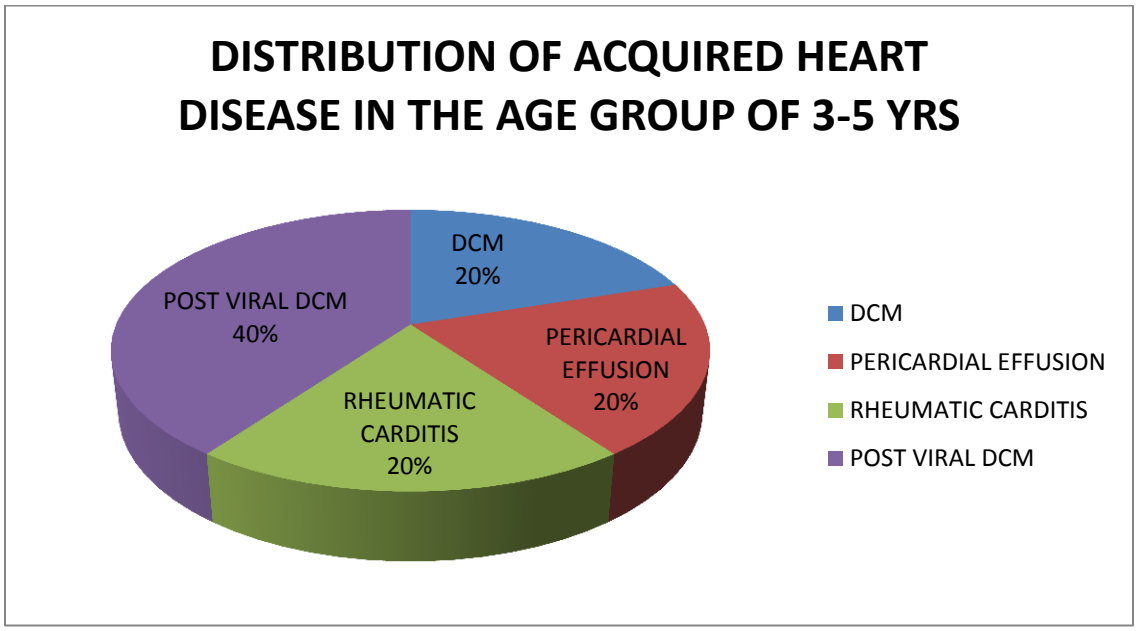



In infants, isolated VSD and PDA are the most common lesions, both being equally common (24%), followed by ASD(osteum secundum type) (16%) and TOF (9%). Among the obstructive lesions, pulmonary stenosis is the most common type, contributing to 3% of heart diseases. Valvular and peripheral stenotic lesions are equally common. TOF is the most common cyanotic heart disease(9%), followed by TGV(3%). Complex heart disease constitutes 7.6% of heart diseases.




In the age group of 1-3 years, isolated VSD is the commonest lesion (50%), followed by ASD (27%) and PDA (11%). TOF is the only cyanotic lesion presenting in this age group, constituting 4% of the lesions. Complex heart disease and Pulmonary stenosis, each contribute 4% of the heart diseases.

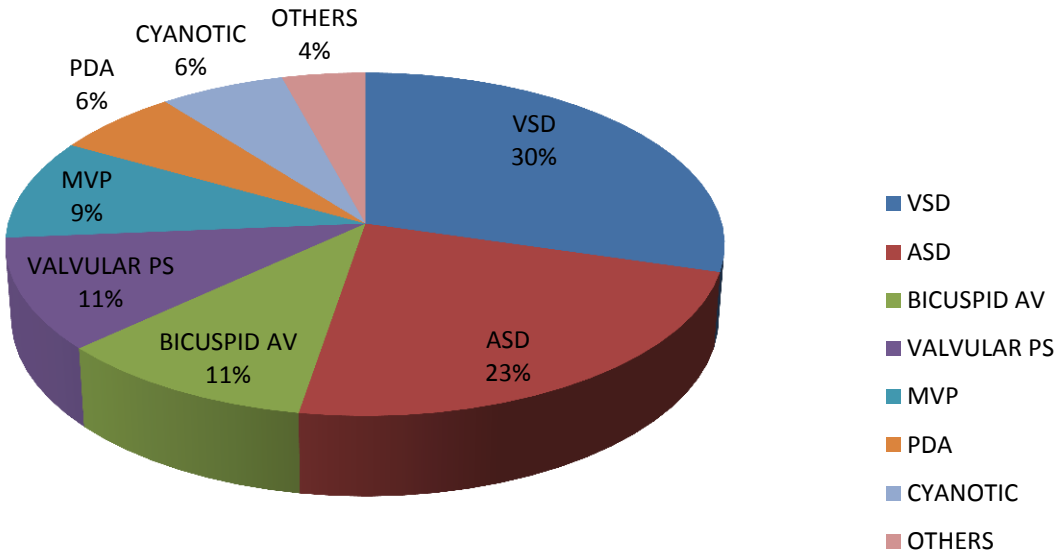





In the preschool children (3-5 yrs), isolated VSD and ASD are equally common (25% each), followed by post viral dilated cardiomyopathy, which constitutes almost 13% of heart disease in this age group. Rheumatic carditis forms 6% of the lesions and mixed heart disease contributes another 6%. A case of pericardial effusion due to hypothyroidism presented in this age group(6%).

In the group of school children(5-12 yrs), 75% of children had acyanotic heart disease, 6% had cyanotic heart disease and 19% had acquired heart disease. VSD was the commonest CHD(30%), followed by ASD(23%). Pulmonary stenosis and aortic stenosis were equally common(11%). Among the acquired heart diseases, RHD was the commonest(52%), followed by rheumatic carditis(30%), and DCM(11%).

## DISTRIBUTION OF CONGENITAL HEART DISEASE IN CHILDREN AGED 5-12 YRS




## DISTRIBUTION OF ACQUIRED HEART DISEASE IN CHILDREN AGED 5-12 YRS

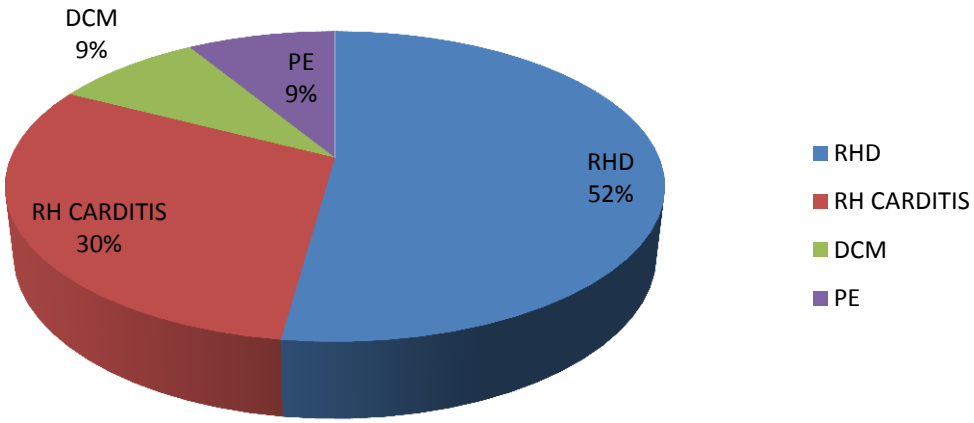


**Table:25 SEX DISTRIBUTION**

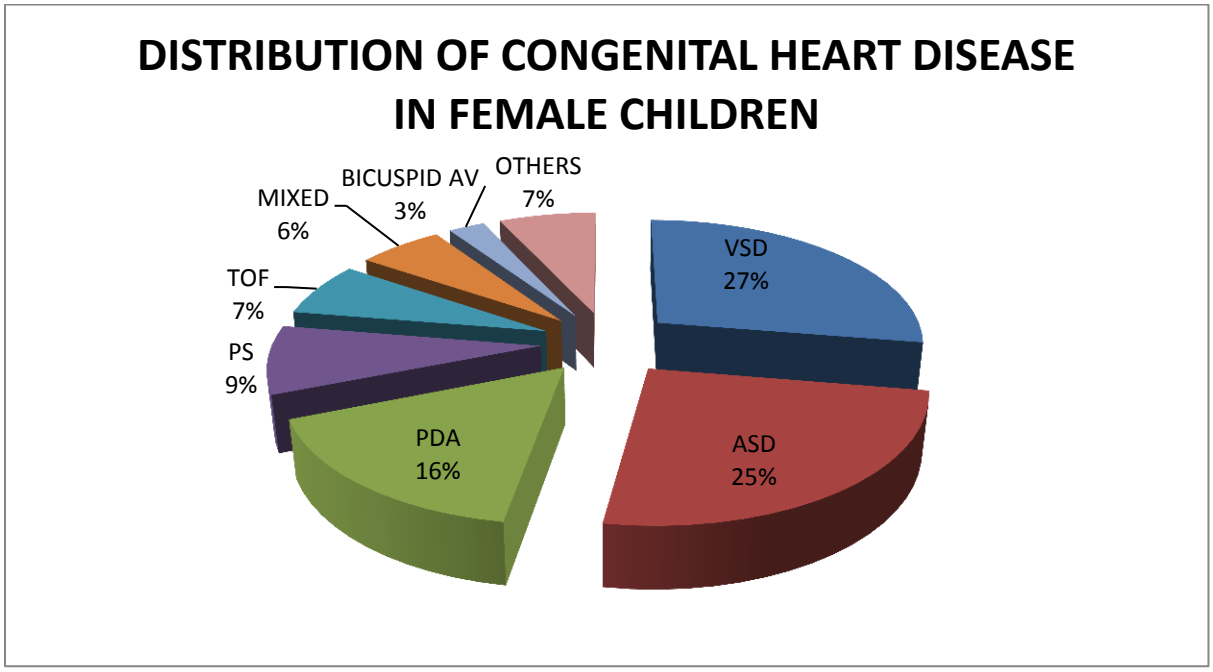
| Sex | No of patients | Percentage | CI |
|---|---|---|---|
| Male | 93 | 41.1 | 34.9 to 47.7 |
| Female | 133 | 58.8 | 52.3 to 65.1 |

**Table 25(a): Sex distribution of various types of heart disease**

| Type of heart disease | Male | Female |
|---|---|---|
| VSD | 29 | 32 |
| ASD-OS | 15 | 29 |
| PDA | 6 | 19 |
| Pulmonary stenosis | 4 | 10 |
| BAV | 6 | 3 |
| MVP | 3 | 7 |
| Complex lesions | 3 | 7 |
| Situs inversus | 0 | 1 |
| Septal hypertrophy | 1 | 0 |
| AV canal defect | 2 | 0 |
| HOCM | 1 | 0 |
| PAPVC | 1 | 0 |
| TOF | 3 | 8 |
| TGV | 2 | 0 |
| TAPVC | 2 | 0 |
| DORV | 1 | 0 |
| Tricuspid atresia | 1 | 0 |
| DCM | 0 | 0 |
| Post viral DCM | 4 | 2 |
| Myocarditis | 1 | 0 |
| Pericardial effusion | 1 | 2 |
| Rheumatic carditis | 2 | 6 |
| RHD/MR | 2 | 7 |
| RHD/MS | 3 | 0 |

Out of the total 226 patients, 133 (59%) were female and 93(41%) Were male. Among the 195 cases of CHD, 79 were male and 116 were female, and the male female ratio is0.7:1. Among the 31 acquired heart disease patients, 14(45%) were male and 17 (55%) were female, and the male female ratio is 0.8:1. CHD

constitutes 85% of heart disease in males and acquired heart disease contributes 15% of total heart disease in males. CHD forms 87% of heart disease in females, and acquired heart disease accounts for 13%.

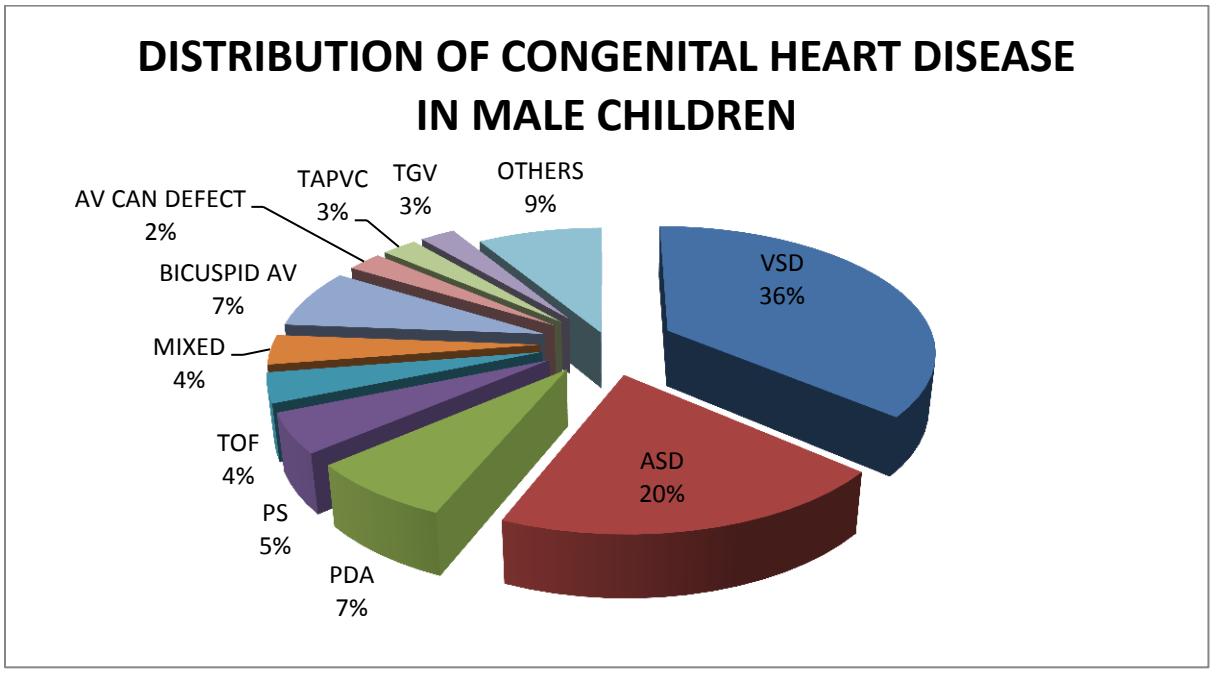


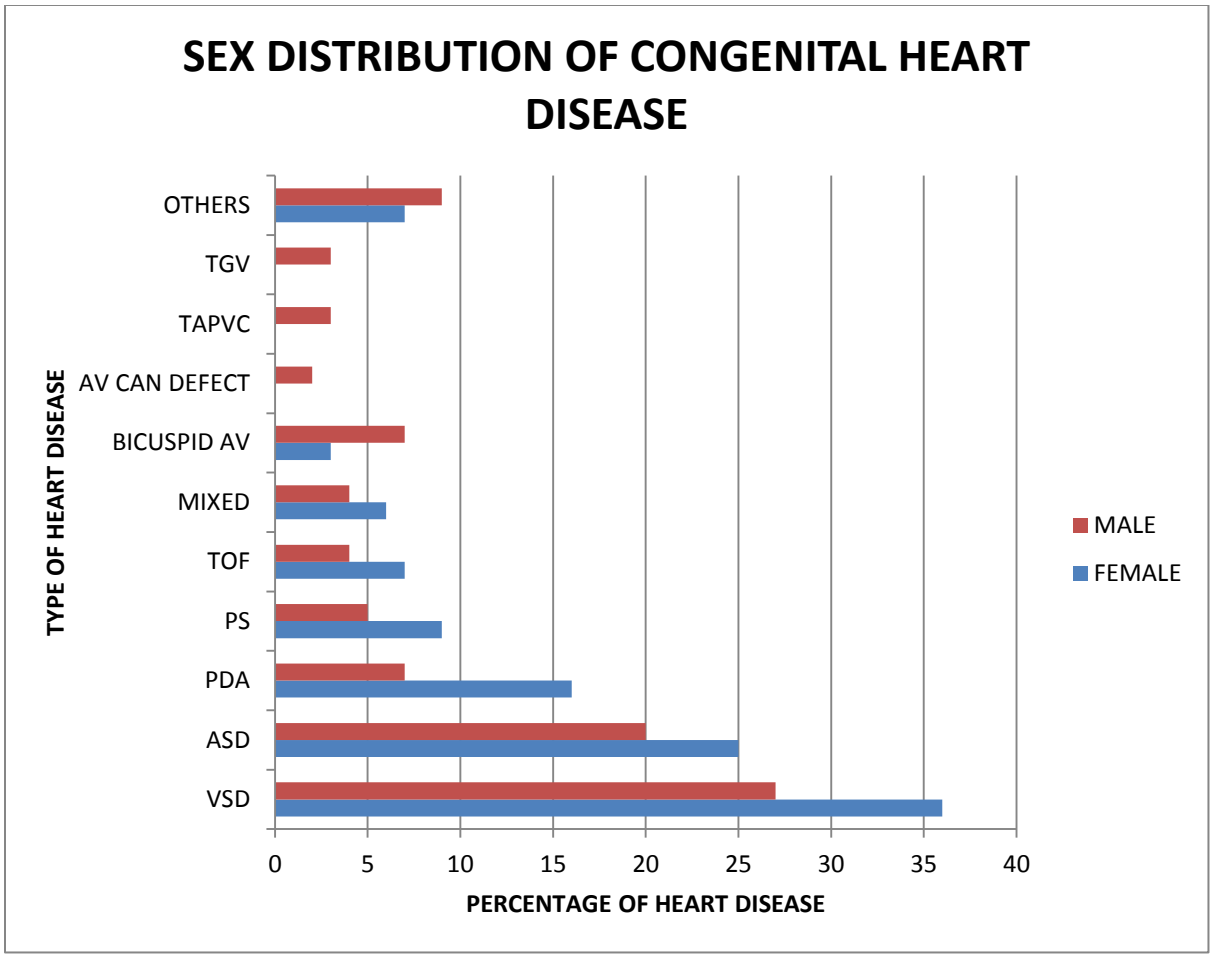

In this study, VSD is the commonest congenital heart disease in female children (27%), followed by ASD (25%). PDA is the next common lesion, constituting 16% of congenital heart disease. TOF is the only cyanotic heart disease presenting in females, amounting for 7% of CHD. Pulmonary stenosis is the most common obstructive lesion(10% of CHD). 1 child presented with situs inversus. Combined acyanotic lesions constituted 7% of CHD in females.

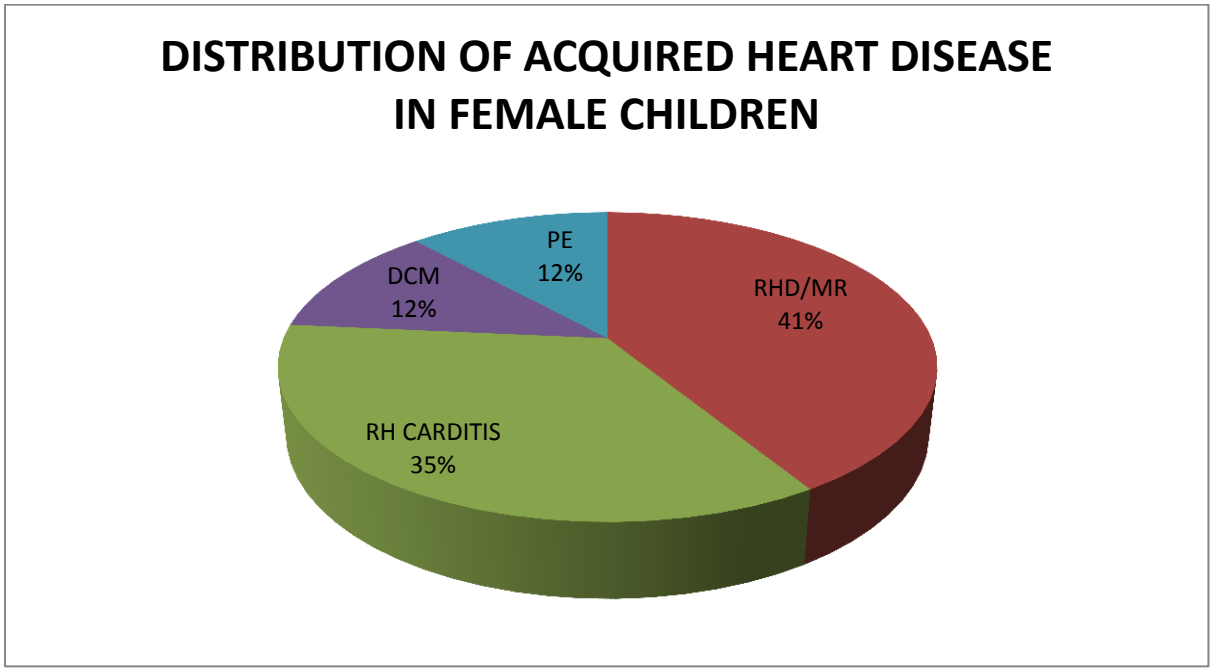
Among male children, VSD is the most common CHD(36%) , and ASD is the second common lesion (20%), followed by PDA(7%). Bicuspid aortic valve is the commonest obstructive lesion, constituting 7% of CHD, followed by pulmonary stenosis, constituting 5% of CHD. TOF is the commonest cyanotic heart

disease, constituting 4% of CHD, followed by TGV(3%) and TAPVC (3%). Complex lesions account for 4% of CHD and AV canal defect constitutes 2% of CHD in males.

VSD, ASD, PDA, pulmonary stenosis, TOF occur more commonly in female children than males. Cyanotic heart diseases other than TOF, including TAPVC, TGV, DORV, Tricuspid atresia are more common in males. Bicuspid aortic valve, AV canal defects, HOCM and PAPVC are more common in male children. MVP and Complex lesions are more common in female children.



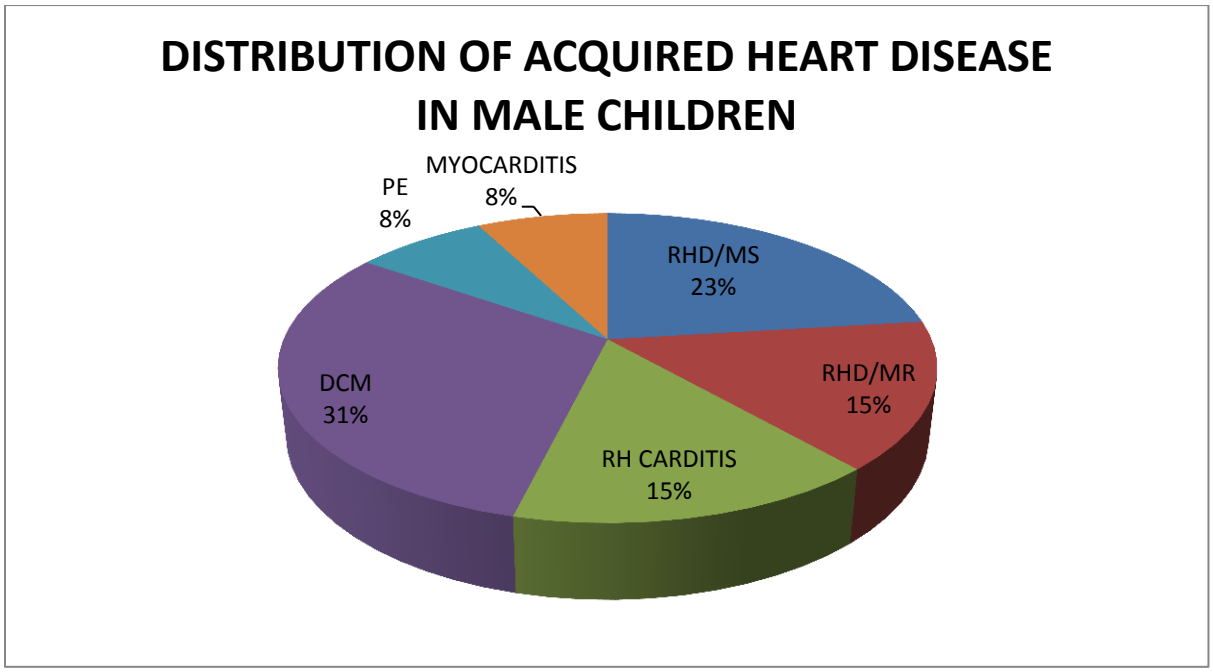


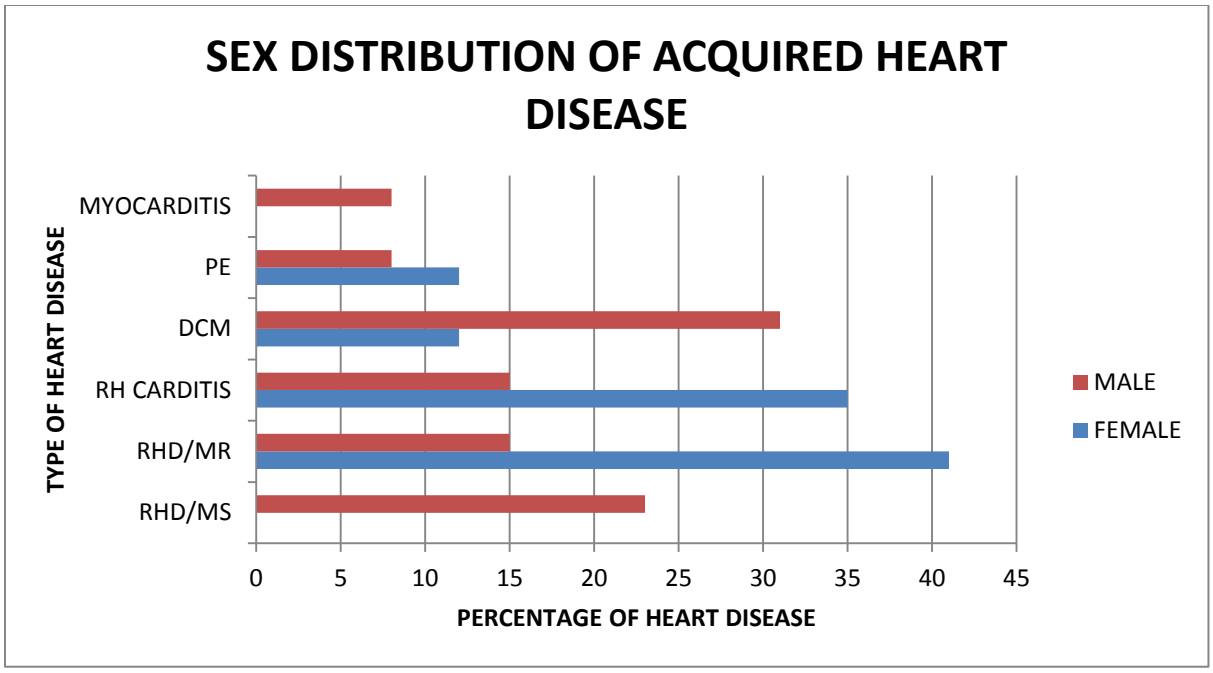




Acquired heart disease constitutes 13% of heart disease in female

children. The most common acquired lesion in females is isolated Mitral regurgitation due to Rheumatic heart disease (41%), followed by rheumatic carditis(35%). Post viral dilated cardiomyopathy contributed to 12 of the acquired lesions, and pericardial effusion due to hypothyroidism formed another 12%. In this study, no cases of Rheumatic Mitral stenosis was found in female children.

In male children, acquired heart disease constituted 13% of total heart disease, of which the most common lesion was post viral dilated cardiomyopathy (31%). Mitral stenosis due to rheumatic aetiology was the second common acquired lesion(23%), followed by mitral regurgitation with MS (15%) and rheumatic carditis(15%).



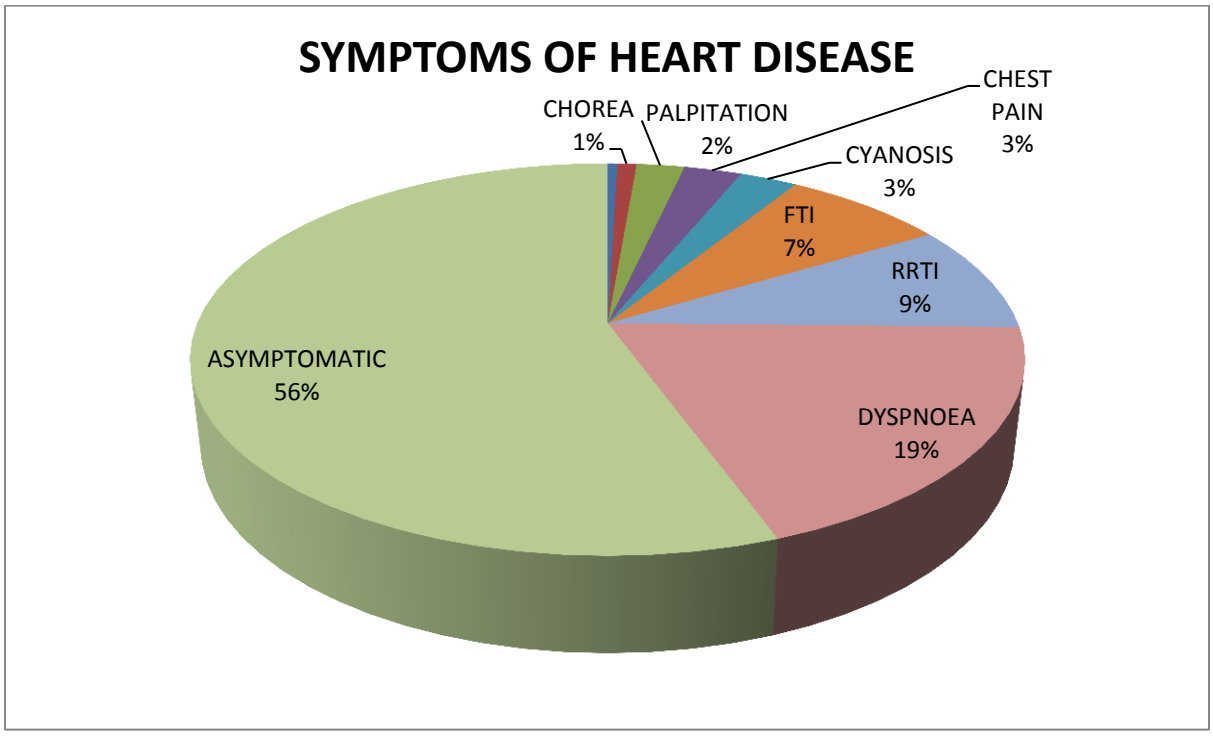


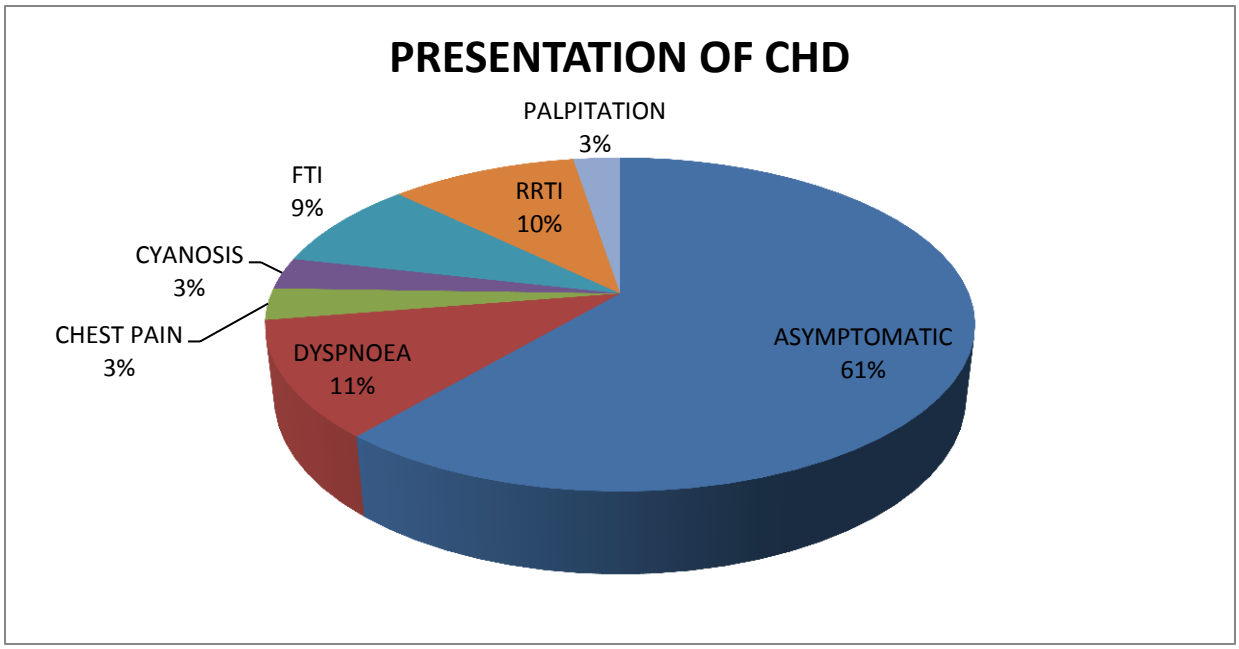

The above mentioned chart shows the sex distribution of acquired heart diseases. Isolated rheumatic MR , rheumatic carditis and pericardial effusion are more common in females, whereas post viral dilated cardiomyopathy, myocarditis and pericardial effusion were more common in males. In this study, mitral stenosis and myocarditis presented only in male children.

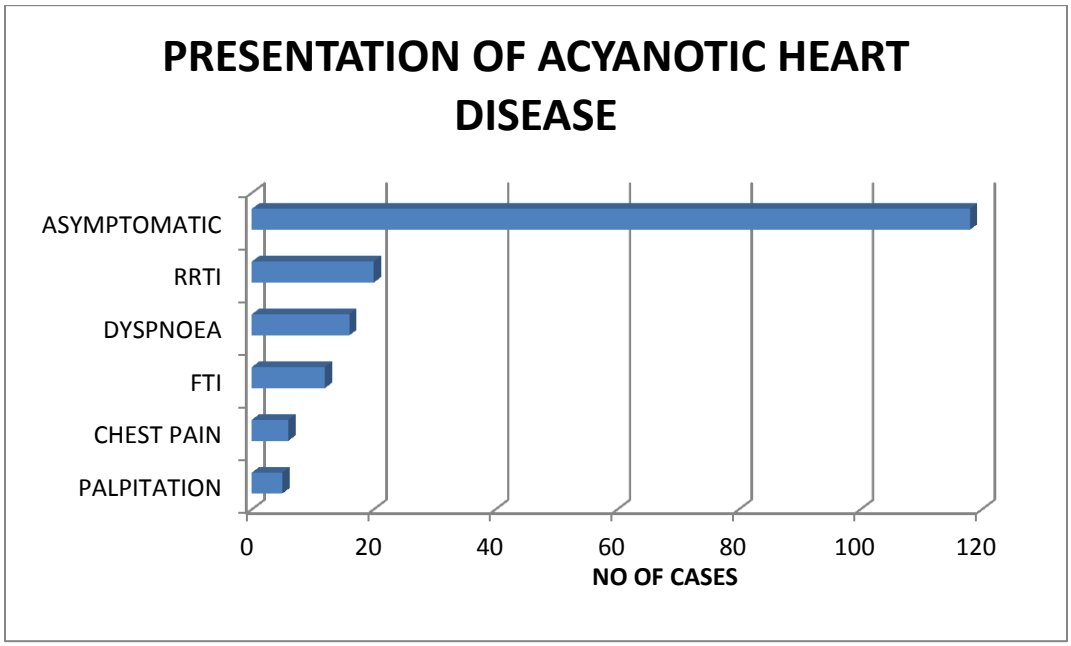
**Table 26 CLINICAL PRESENTATION OF HEART DISEASE**

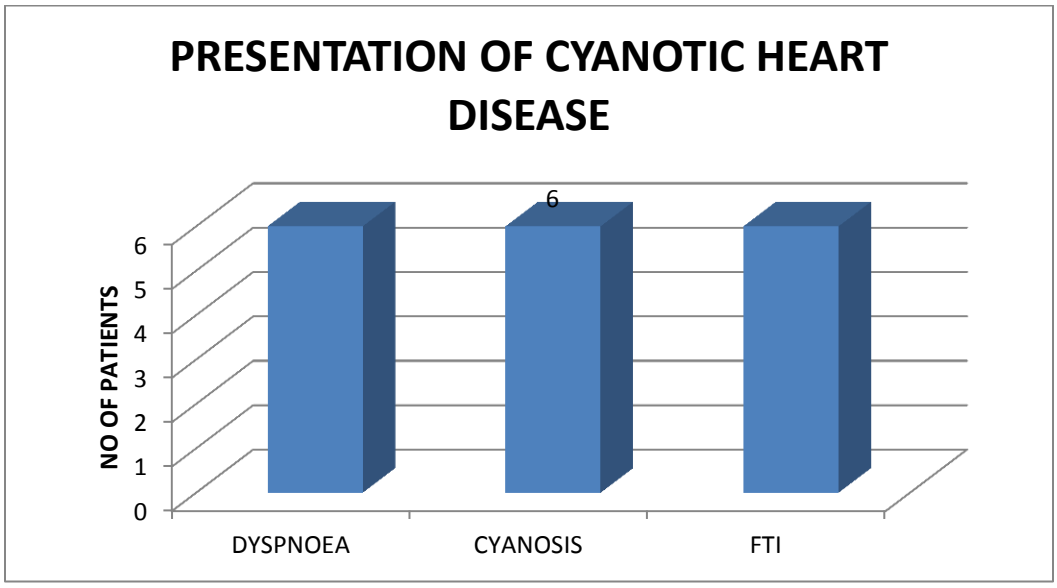
| MAJOR PRESENTING SYMPTOM | NUMBER OF CASES | | | |
|---|---|---|---|---|
| | CONGENITAL | | ACQUIRED | TOTAL |
| | ACYANOTIC | CYANOTIC | | |
| Asymptomatic | 118 | 0 | 7 | 125 |
| Dyspnoea | 16 | 6 | 21 | 43 |
| Chest pain | 6 | 0 | 0 | 6 |
| Chorea | 0 | 0 | 2 | 2 |
| Cyanosis | 0 | 6 | 0 | 6 |
| Failure to thrive | 12 | 6 | 0 | 18 |
| Recurrent respiratory tract infections | 20 | 0 | 0 | 20 |
| Palpitation | 5 | 0 | 0 | 5 |
| Edema | 0 | 0 | 1 | 1 |
| | 177 | 18 | 31 | 226 |

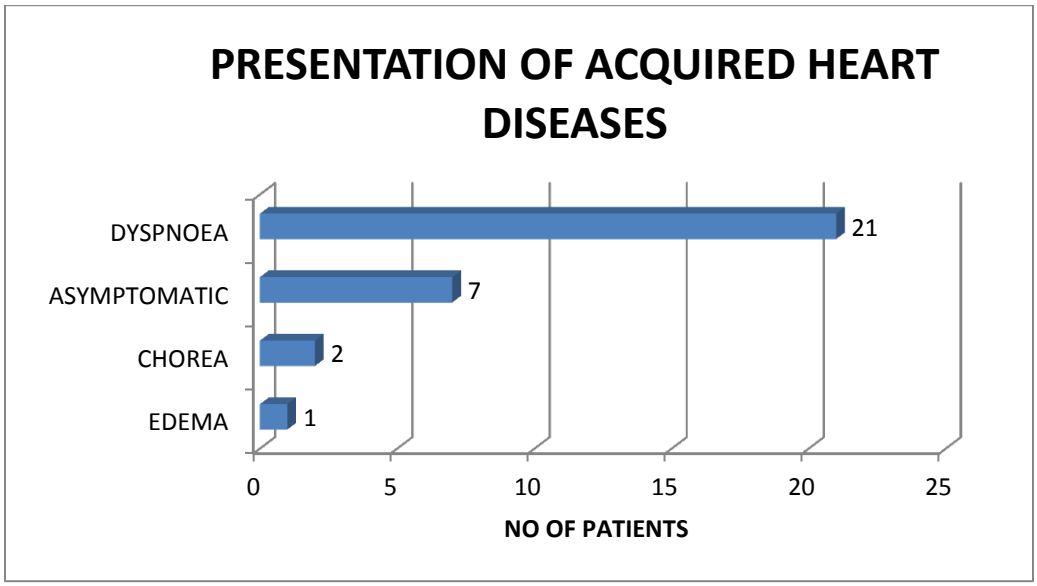
About 56% of the cases were asymptomatic and were diagnosed incidentally due to the presence of murmur. The commonest presenting symptom was dyspnoea (19%). The next common symptom was recurrent respiratory tract infections(9%) and failure to thrive(7%). 61% of CHD cases were asymptomatic. 11% of cases with CHD presented with dyspnoea and 10% of them presented with RRTI. All cases of cyanotic heart disease were symptomatic; 1/3 rd of them presented with cyanosis, another 1/3 rd presented with dyspnoea as the predominant symptom and the other third presented with failure to thrive symptoms. 67% of patients with acyanotic heart disease remained asymptomatic. RRTI and dyspnoea were the most common presentations. 68% of acquired heart disease patients presented with dyspnoea, and 22% of them were asymptomatic 6.5% presented with chorea and 3% with pedal edema. The predominant symptoms of different types of heart disease are shown in the charts below.

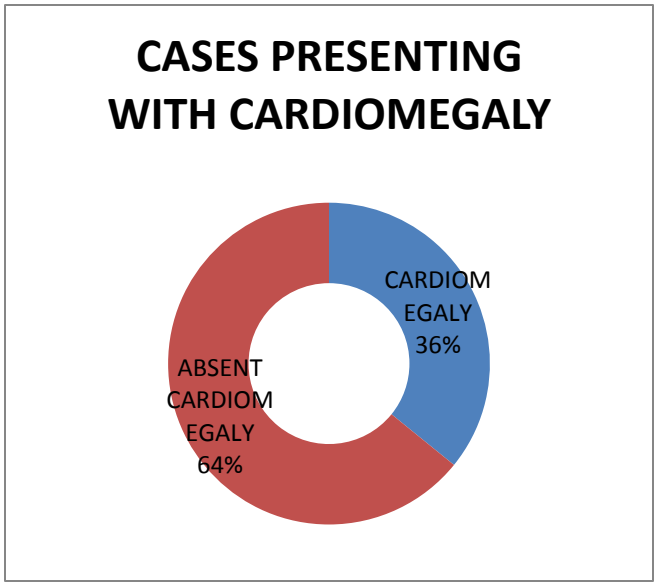


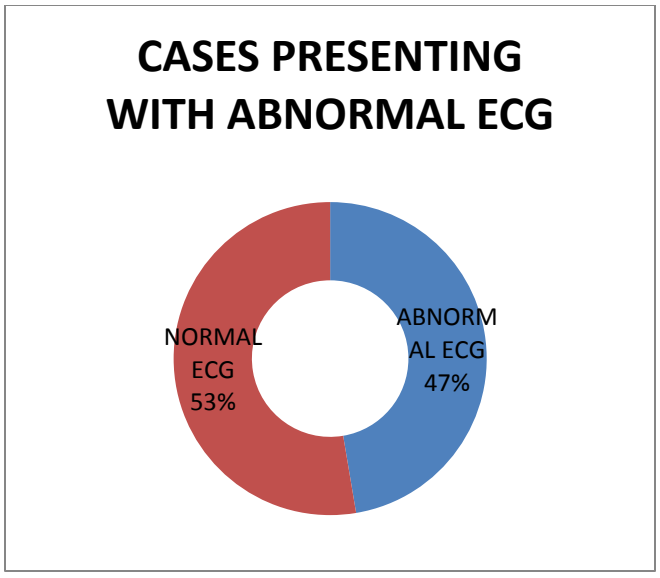

PRESENTATION OF CHD
PALPITATION
3%
FTI
9%
RRTI
10%
CYANOSIS
3%
CHEST PAIN
3%
DYSPNOEA
11%
ASYMPTOMATIC
61%


PRESENTATION OF ACYANOTIC HEART DISEASE
ASYMPTOMATIC
RRTI
DYSPNOEA
FTI
CHEST PAIN
PALPITATION
0
20
40
60
80
100
120
NO OF CASES

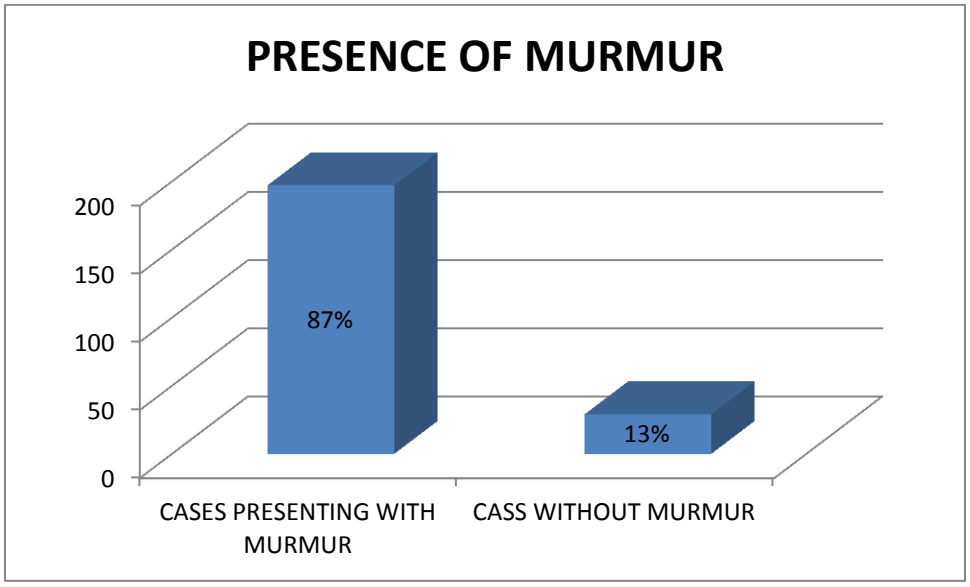

PRESENTATION OF CYANOTIC HEART DISEASE
NO OF PATIENTS
0
1
2
3
4
5
6
6
DYSPNOEA
CYANOSIS
FTI


PRESENTATION OF ACQUIRED HEART DISEASES
DYSPNOEA
ASYMPTOMATIC
CHOREA
EDEMA
21
7
2
1
0
5
10
15
20
25
NO OF PATIENTS




Out of 226 cases, only 81(36%) patients presented with cardiomegaly in X ray chest and 107 patients(46%) had ECG changes




Among the cases that did not present with murmur, 21% were cyanotic heart diseases, 52% were acyanotic heart diseases, and 27% were acquired heart diseases. The most common cases presenting without murmur were MVP, TGV, Tricuspid atresia, dilated cardiomyopathy and pericardial effusion.

**MEAN AGE OF PRESENTATION OF VARIOUS TYPES OF HEART DISEASE**

**TABLE 27**

| TYPE OF HEART DISEASE | MEAN AGE OF PRESENTATION IN MONTHS |
|---|---|
| ASD | 58.31 |
| AV CANAL DEFECT | 2.5 |
| BAV | 105.75 |
| POST VIRAL DCM | 69.17 |
| DORV | 84 |
| PAPVC | 79 |
| HOCM | 120 |
| COMPLEX ACYANOTIC HEART DISEASE | 39.5 |
| MVP | 99.8 |
| MYOCARDITIS | 5 |
| PDA | 31.6 |
| PERICARDIAL EFFUSION | 84.7 |
| PULMONARY STENOSIS | 87.57 |
| RHEUMATIC CARDITIS | 103.4 |
| RHEUMATIC MR | 111.5 |
| RHEUMATIC MS | 140.7 |
| SEPTAL HYPERTROPHY | 2 |
| SITUS INVERSUS | 7 |
| TGV | 3 |
| TOF | 37.4 |
| VSD | 54.2 |
| TRUNCUS ARTERIOSUS | 3 |

**COMPLICATIONS ASSOCIATED WITH VARIOUS TYPES OF HEART DISEASE**

Out of the 195 cases with congenital heart disease, 32(16%) presented with complications. The most frequent complications observed were pulmonary hypertension, cardiac failure and infective endocarditis. Pulmonary hypertension was frequently observed in cases of VSD of the sub aortic type and ASD. Among cyanotic heart diseases, TAPVC and Truncus arteriosus presented with pulmonary

hypertension,and no case of isolated TOF presented with PHT. Among the acquired heart diseases, 45% of cases presented with complications . Rheumatic MS was frequently associated with PHT. A case of rheumatic MR presented with infective endocarditis , resulting in cardiac failure.

**Table 28: Complications Of Various Groups Of Heart Disease**

| Type of heart disease | Complications | Frequency | Percentage | 95% CI |
|---|---|---|---|---|
| **Congenital Acyanotic heart disease (no:178)** | Failure | 13 | 7.3 | 4.1 to 11.9 |
| | PHT | 30 | 16.9 | 11.9 to 22.9 |
| | IEC | 1 | 0.6 | 0.02 to 2.7 |
| **Congenital Cyanotic heart disease (no:18)** | Failure | 0 | 0 | 0 to 15.3 |
| | PHT | 2 | 11.1 | 1.9 to 32.1 |
| | IEC | 0 | 0 | 0 to 15.3 |
| **Acquired heart disease (no:30)** | Failure | 14 | 46.7 | 29.5 to 64.4 |
| | PHT | 4 | 13.3 | 4.4 to 29.1 |
| | IEC | 1 | 3.3 | 0.2 to 15.4 |

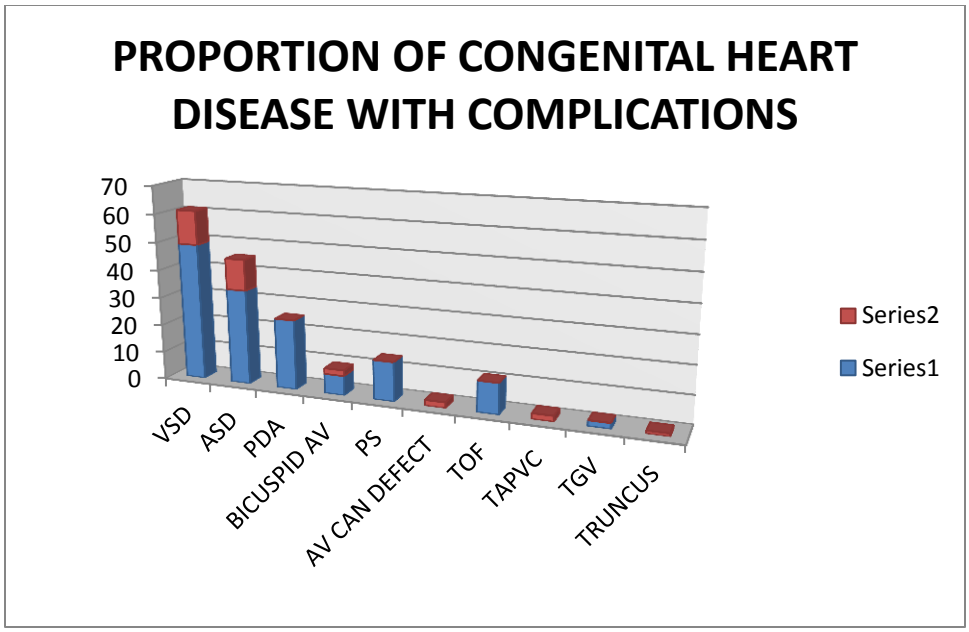
**TABLE 29: COMPLICATIONS ASSOCIATED WITH VARIOUS TYPES OF HEART DISEASE**

| TYPE OF HEART DISEASE | NO OF CASES WITH PHT | PERCENTAGE |
|---|---|---|
| Subaortic VSD | 11 | 29 |
| ASD | 11 | 29 |
| PDA | 3 | 8 |
| BAV | 2 | 6 |
| TAPVC | 2 | 6 |
| TRUNCUS | 1 | 3 |
| RHD/MR | 1 | 3 |
| RHD/MS | 3 | 8 |
| Others | 3 | 8 |

**TABLE 30: CASES PRESENTING WITH CARDIAC FAILURE**

| TYPE OF HEART DISEASE | NO OF CASES | PERCENTAGE |
|---|---|---|
| VSD | 10 | 33.3 |
| Rheumatic carditis | 6 | 20 |
| DCM | 5 | 16.7 |
| MR | 2 | 6.7 |
| TAPVC | 2 | 6.7 |
| AV canal defect | 2 | 6.7 |
| Truncus arteriosus | 1 | 3.3 |
| Myocarditis | 1 | 3.3 |
| Complex heart disease | 1 | 3.3 |
| **Total** | 30 | 100 |

Out of the total 226 cases, 30(13%) presented with signs of failure. 33% of these cases were isolated VSDs, mainly of the subaortic type with pulmonary hypertension, and one case of VSD went for failure due to infective endocarditis. The other common lesions presenting with failure were rheumatic carditis(20%) and post viral dilated cardiomyopathy(16.7%). Isolated PDA and ASD did not present with failure signs, whereas a case of mixed heart disease with ASD-OS and subaortic VSD presented with failure.




About 18% of VSD presented with cardiac failure, and all these cases were sub aortic VSDs. 24% of ASDs presented with complications only 8% of PDAs presented with PHT. All cases of TAPVC and truncus presented with PHT and failure. 45% of acquired heart diseases presented with complications. The most common complications observed were pulmonary hypertension and failure. 83% of post viral DCM cases presented with failure. 75% of rheumatic carditis patients presented with failure. 22 % of cases with mitral regurgitation presented with failure. 100% of cases with mitral stenosis presented with PHT.

**TABLE 31:NUTRITIONAL STATUS OF CHILDREN WITH HEART DISEASE**

| **Weight for height/BMI** | Less than -3 | -3 to -2 | -2 to -1 | -1 to +1 |
|---|---|---|---|---|
| Acyanotic | 8(4.5%) | 34(19.2%) | 54(30.5%) | 81(35.8%) |
| Cyanotic | 8(44.4%) | 9(50%) | 1(5.6%) | 0 |
| Acquired | 6(19.4%) | 11(35.5%) | 10(32.2%) | 4(12.9%) |
| Total | 22 (9.7%) | 54 (23.9%) | 65 (28.7%) | 85(37.6%) |

| **Height for age** | Less than -3 | -3 to -2 | -2 to -1 | -1 to +1 |
|---|---|---|---|---|
| Acyanotic | 6(3.4%) | 9(5.1%) | 47(26.6%) | 115(64.9%) |
| Cyanotic | 16(88.9%) | 1(5.55%) | 1(5.55%) | 0 |
| Acquired | 1(3.2%) | 7(22.6%) | 9(29%) | 14(45.2%) |
| Total | 23 (10.1%) | 17 (7.5%) | 57 (25.22%) | 129(57%) |

In our study 34.07% of patients with heart disease presented with moderate to severe wasting. 28.7% of patients presents with mild wasting. 37.23% of patients had normal weight for height or BMI. Among the acyanotic group, 4.5% had severe wasting; 19.2% had moderate wasting; 30.5% had mild wasting and 35.8% of them had normal BMI. Most of the children with cyanotic heart disease had moderate(50%) to severe wasting(44.5%). Among children with acquired heart disease, most of them presented with mild(32.2%) to moderate wasting(35.5%)

17.6% of patients with heart disease presented with moderate to severe stunting and 25.22% patients presents with mild stunting of growth. 57.18 % of patients had

normal height for age.  Among the acyanotic group, most of the children had normal height for age(65%). 27% had mild stunting. Among the cyanotic group, most of the children presented with severe stunting(89%). Among the children with acquired heart disease, 57% of the children had normal height for age;  25% of them had mild stunting.

# DISCUSSION

## DISCUSSION

In our study the prevalence of heart disease in children aged 1month to 12 years was 9 per 1000 population. The prevalence of CHD was 8 per 1000.Though this cannot be extrapolated to the normal population, as the study was carried out in a sector of people seeking medical care in a tertiary care hospital, this value is comparable to other hospital based studies in India. Rajendra Kumar Jatav et al reported a CHD prevalence of 8.55 per 1000 which is very similar to our results[47]. Kurshid Ahmed et al reported a prevalence of 1.12% in a study conducted in children in a tertiary care hospital in Srinagar[36]. In a study conducted in the school children in Uttar Pradesh, Mukul Misra et al reported a prevalence of 1.3%[37]. Najaf Masood et al reported a prevalence of 1% in a hospital based study in Rawalpindi, Pakistan[48]. All these studies show greater prevalence of CHD compared to our study. The prevalence of acquired heart disease in our study was 1 per 1000. Rheumatic heart disease constituted 64% of acquired heart disease. The prevalence of RHD in our study was 0.8 per 1000. Jose V J et al reported a declining prevalence of RHD (0.68% per 1000) in school surveys in Tamil Nadu[49]. Dipanker Prajapathi et al[50] reported an RHD prevalence of 0.9 per 1000 . Yadav et al reported an RHD prevalence of 0.73 per 1000 in a school survey done in Indore[51]. A more recent hospital based survey in India shows a prevalence of 5-26%[52], which is high number when compared to the results of our study.

In our study, the male female ratio of children with heart disease was 0.7:1. The male female ratio in the congenital heart disease subgroup was 0.7:1. This is in accordance with a study from Christian Medical College , Vellore, by Anushula Tandon et al[53], that evaluated the risk factors for CHD, but this study included adult population as well. Most of the studies from India show a male predominance of CHD. A study conducted at Srinagar Govt. Medical College Hospital showed a male female ratio of 1.2:1, and a study from a tertiary care hospital at Peshawar showed a male female ratio of 2:1 in patients with congenital heart disease[54].

In our study population, the male-female ratio of acquired heart disease was 0.8:1, of which RHD presented with a male female ratio of 0.5:1.Dipanker et al reported a male female ratio of 0.9:1 in children with RHD[50]. Yadav et al[51] reported a male female ratio of 1.63:1.

In our study 52% of children with heart disease presented in the school age(5 to 12 years), followed by the infantile period(1 month to 1 year). Almost 51% of children with acyanotic heart disease were identified in the age group of 5 to 12 yrs, and 31% were diagnosed within 1 year of age. 56% of children with cyanotic heart disease were identified within 1 year of age and 33% in the age group of 5 to 12 years.

Smitha Mudada et al also reported greater relative prevalence of CHD is in the age group of 5 – 12 years followed by 1 – 3 years of age, in a study conducted at a tertiary care hospital in Aurangabad[55]. Rukeya Begam et al reported maximum number of CHD cases in age group of 1 month to 1 year children followed by 1 – 5 years of age

group[56]. Najma Patel et al[57] reported maximum number of cases in the infantile age group((75%). In a study conducted at Peshawar tertiary care hospital[54], most of the cases of CHD presented in the age group of 1-5 yrs(46%), followed by the age group of 5 to 12 yrs(29%). In a study done in a teaching hospital in Karimnagar, Andhra Pradesh, 37% of cases were diagnosed in the neonatal period( 19%), followed by the age group of 6 to 12 yrs(14%)[47]. These differences observed may be due to the routine screening and referral of children under the school health programme.

In our study, 74% of the acquired heart diseases presented in the school going age(5-12 yrs), and 16% in the pre school age(3-5 yrs). 95% of RHD presented in the age group of 5-12 yrs. 5% of RHD presented in preschool children. All cases of rheumatic MS and MR clustered in the age group of 5-12 yrs. 12.5% of rheumatic carditis cases presented in preschool age, while 87.5 % of them presented in school going children. UM Sani et al @ Nigeria noted that RHD is common in the age group of 10 -15 years age group followed by 5- 10 years age group. Shankar et al, in a study done at Central Nepal, also reported that RHD is common in the age group of 10 to 15 years of age followed by 4 – 9 years of age. Yadav et al reported nil case of active rheumatic fever /carditis in his study[51], and all cases of RHD were reported in the age group of 13-16 yrs. This study from Indore shows greater age of onset of RHD[51]. Dipanker et al reported greater prevalence of RHD in the age group of 5-12 yrs[50], similar to our study. But in this study no case of RHD was detected in chidren below 5 yrs. The presentation of rheumatic carditis in the age group of 3-5 yrs in our study emphasizes the

need to consider RHD as a possible diagnosis even in younger age groups of our population.

In our study, majority of patients presented with acyanotic CHD, this is similar to other studies from India and worldwide. Among the acyanotic heart disease, VSD is the most common lesion, comprising 31% of total heart disease, followed by ASD(22%) and PDA(13%). This is similar to the results of a study conducted in a tertiary care hospital in Uttarkhand by Navneet Kumar et al, that showed greater prevalence of VSD in the acyanotic group, comprising 31% of heart disease. In a study from CMC Vellore, Anushula Tandon et al reported ASD as the commonest lesion[53] in the study population(44%), followed by VSD(22%). But this study included both paediatric and adult population. Sandeep V Harshangi et al reported a greater prevalence of VSD in the study population (30%), followed by ASD and PDA. This is in accordance with our study results. Bharadwaj et al reported a greater prevalence of VSD(33%), followed by ASD(19%) and TOF(16%) in the paediatric OPD in a tertiary referral center in central India[58]. Rukeya Begam et al, reports VSD as the commonest lesion, followed by ASD, PDA, and Pulmonary stenosis[56]. These results are similar to that of our study.

Most of the studies from India and all over the world report a higher prevalence of VSD than other lesions. A study conducted in a tertiary care cardiac hospital of Karachi by Najma Patel et al[57] showed a very differing pattern, with TOF being the commonest leion(24%), followed by VSD(21%).

In the cyanotic group of children, TOF is the commonest lesion in our study, followed by TGV and TAPVC. Nadia Mohammed et al[42] and Khurshid Ahmed Wani et al[36] showed similar results. Sandeep V. Harshangi et al, reported TOF as the commonest cyanotic heart disease, followed by TGV in a study conducted in a tertiary care hospital in Nepal[59]. Anushula Tandon et al also reported TOF as the commonest cyanotic heart disease in a study done at CMC, Vellore[53].

Among the acquired heart diseases, Rheumatic carditis and Rheumatic mitral valve disease were the commonest lesions in our study, followed by Dilated cardiomyopathy of post viral etiology. UM Sani et al at Sokoto, Nigeria reported

RHD as commonest, followed by Dilated cardiomyopathy and Pericardial effusion, and Kawasaki disease was the least common. In our study, no case of Kawasaki disease was identified. This may be due to regional variation in disease pattern.

In this study, VSD, ASD, PDA, TOF and Pulmonary Stenosis were more common in females , whereas AV Canal defects, Bicuspid Aortic Valve, TGV, TGA, TAPVC, PAPVC were common in males. In a study done at a tertiary hospital in Karachi, VSD, ASD, AS, PS, TOF, TGA were more prevalent in males, and PDA was the only lesion that showed a female preponderance[57]. Dipanker et al reports a female preponderance of ASD in an epidemiological study from Nepal[50]. Fazlur et al reported a female dominance of PDA and a male dominance of AV canal defects, pulmonary

stenosis and aortic stenosis[54]. Shah et al reported a female preponderance of VSD, PDA and PS; and male preponderance of TGA and AS[60]. This is in accordance with our observations.

Among children with acquired heart disease, Rheumatic carditis and Rheumatic MR showed a female preponderance, while Rheumatic MS, Post viral dilated cardiomyopathy and myocarditis were commonly observed in males. Dipanker et al reported no difference in the prevalence of RHD in both sexes[50].

In our study, 56% of patients were asymptomatic and dyspnea was the common presenting symptom(19%); 7% of children presented with failure to thrive symptoms. In sharp contrast to our study, Sandeep V Harshangi reported breathlessness as the commonest symptom in his study group(78%), followed by LRTI (60%). Only 6% of the cases were asymptomatic in this study[59]. Shah et al reported FTT and developmental delay as the commonest presentation, followed by breathlessness[60]. Sonali Tank et al , in a study carried out in a public hospital in Central Mumbai, reported breathlessness as the commonest symptom. Only 8% of patients were asymptomatic in the study group[38].

In our study, 67% of acyanotic heart disease patients were asymptomatic; RRTI and dyspnea were the next commonest presentations. Cyanotic heart disease patients were all symptomatic; one third presenting with cyanosis, another third with failure to thrive symptoms, and the other third of them presented with breathlessness. 68% of patients with acquired heart disease presented with breathlessness and 22% of

them were asymptomatic. All cases of RHD were symptomatic and 2 cases presented with chorea.

In this study, only 36% of patients presented with cardiomegaly, and 47% had abnormal ECGs; the rest had normal ECG and normal heart in CXR, whereas almost 87% of children presented with murmurs on cardiac auscultation. This observation emphasizes the need for high degree of suspicion and prudence required in the diagnosis of heart disease in relatively asymptomatic children, as early diagnosis will affect the prognosis of patients positively and lead to higher success rates of surgical procedures performed in these patients.

In our study,16% of patients presented with complications. The most frequent complications observed were pulmonary hypertension, cardiac failure and infective endocarditis.

Pulmonary hypertension was frequently observed in cases of VSD of the sub aortic type and ASD. Among cyanotic heart diseases, TAPVC and Truncus arteriosus presented with pulmonary hypertension,and no case of isolated TOF presented with PHT. Among the acquired heart diseases, 45% of cases presented with complications . Rheumatic MS was frequently associated with PHT.

Of the 226 patients,13% presented with signs of failure. 33% of these cases were isolated VSDs, mainly of the subaortic type with pulmonary hypertension, and one case of VSD went for failure due to infective endocarditis. The other common lesions

presenting with failure were rheumatic carditis(20%) and post viral dilated cardiomyopathy(16.7%). Isolated PDA and ASD did not present with failure signs, whereas a case of mixed heart disease with ASD-OS and subaortic VSD presented with failure. A case of rheumatic MR presented with infective endocarditis , resulting in cardiac failure.

About 18% of VSD presented with cardiac failure, and all these cases were sub aortic VSDs. 24% of ASDs presented with PHT and only 8% of PDAs presented with PHT. 83% of post viral DCM cases presented with failure. 75% of rheumatic carditis patients presented with failure. 22 % of cases with mitral regurgitation presented with failure. 100% of cases with mitral stenosis presented with PHT.

Sandeep V Harshangi et al reported 56% of patients with cardiac failure in his study[59]. Smitha Mundhadha found 9% of patients with VSD in the study presenting with pulmonary hypertension, and only 1% of them presented with failure[55]. This number is considerably less than our study that showed almost 18% of VSDs going for complications. The author also reported 0.1% of patients with PDA presenting with failure[55], whereas in our study, no case of PDA went for complications.

# CONCLUSION

## CONCLUSION

The prevalence of CHD among children who attended Paediatric OPD of Theni Medical College Hospital during a two year period was 8 per 1000. This correlates with some studies from south India, but the prevalence is less when compared to most hospital based studies from other parts of India.

The prevalence of RHD was comparatively lower in our study, but the age of onset of rheumatic carditis was earlier in our study population when compared to other studies from various parts of India.

VSD was the commonest acyanotic lesion. TOF was the commonest cyanotic lesion. Rheumatic heart disease formed the major proportion of acquired heart disease.

Most of the acyanotic heart diseases and RHDs presented in the age group of 5-12 years. Majority of the cyanotic lesions presented within 1 year of age.

Overall female predominance was noted in the study. VSD,ASD, PDA, TOF, Pulmonary stenosis, Rheumatic carditis and Rheumatic MR showed female preponderance. Aortic Stenosis, AV canal defects, TGA,TGV, TAPVC showed male predominance.

More than half of the study population were asymptomatic and were diagnosed on the basis of clinical suspicion. Most of the acyanotic lesions were asymptomatic. Cyanotic lesions and RHDs were all symptomatic.

16% of CHDs and 45% of RHDs went for complications. About 18% of VSD presented with cardiac failure, and all these cases were sub aortic VSDs. 24% of ASDs presented with complications only 8% of PDAs presented with PHT.

There are a few studies in India regarding the profile of congenital and rheumatic heart disease pattern in children. Most of these are school surveys and cannot be extrapolated to the general population. Many recent studies have pointed out a declining trend of RHDs in many parts of India. Our study also shows a lesser prevalence of RHD among children with heart disease. CHDs form the majority of cardiac lesions and most of them are asymptomatic. Accurate assessment of prevalence of CHD is needed to understand the demands placed on healthcare system. Several studies from abroad have shown changing incidence and pattern of CHD in various geographical locations. Hospital based studies will be more useful when obtained from the same hospital over different periods of time. This will also help determine if there is an actual decline in the incidence of RHDs.

This study also emphasizes the need to screen asymptomatic children for CHD, as early diagnosis and early intervention can alone prevent complications, morbidity and mortality in these children.

## LIMITATIONS OF THE STUDY

As this is a hospital based study, the results cannot be extrapolated to the general population. Long term follow up is required to assess the benefits of early intervention and also to assess the availability of advanced treatment options to the general population, and the degree of access to health care.

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# PROFORMA

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NAME

AGE

SEX

**SYMPTOMS - DURATION**

1.PALPITAIONS

2.BREATHLESSNESS

3.SYNCOPE

4.FAILURE TO THRIVE

5.RRTI

6.SWELLING OF LEGS

7.CHEST PAIN

8. BLUISH DISCOLORATION

**ANTENATAL AND BIRTH DETAILS :**

PARITY :

MATERNAL ILLNESS GDM

MATERNAL AGE AT CONCEPTION

PREVIOUS FETAL / NEONATAL DEATHS:

**FAMILY HISTORY**

CONSANGUINITY

**CLINICAL EXAMINATION**

Pallor/Cyanosis/Clubbing/Pedal edema

Height ;Weight ;

Congenital markers/Anomalies

Mental retardation

PR- BP- UL /LL

**SYSTEMIC EXAMINATION**

CVS RS

ABD CNS

**INVESTIGATIONS**

COMPLETE BLOOD COUNT

X RAY CHEST

ECG

ECHOCARDIOGRAM

OTHERS